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Model Engineer

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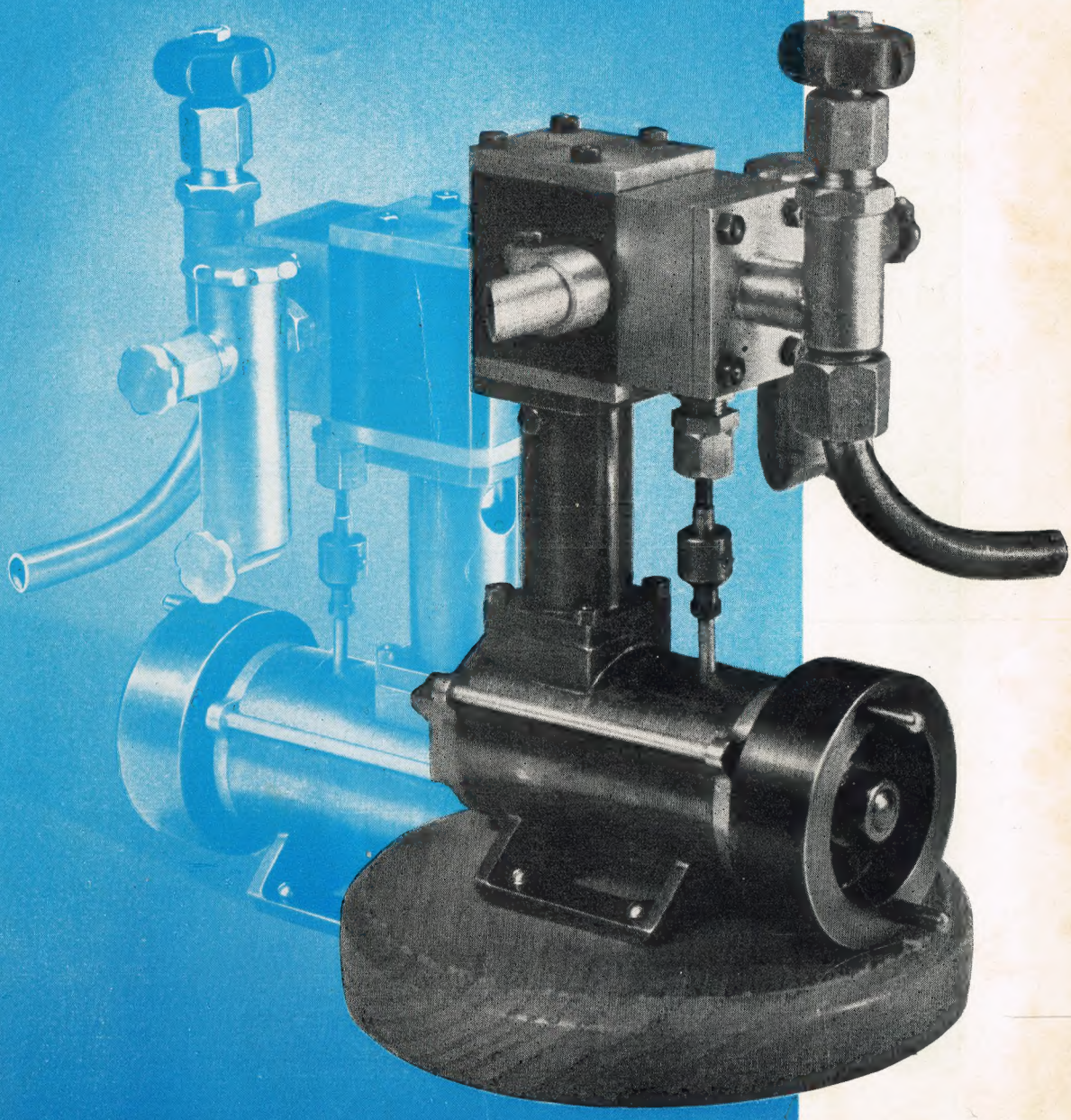

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TELEVISION

MEDIUM OF THE FUTURE

by Maurice Gorham

This is TV as seen from the vantage point of a Director of Television's desk, with unlimited facilities for inquiring into every aspect of planning, production and control. The author was in fact Head of B.B.C. Television from 1946-7 and has been associated with the medium from its earliest days. He has also studied methods used in France, Holland and the United States.

It is not a textbook but is intended for the reader and/or viewer with an enquiring mind who would like to know all there is to know on the subject.

The author begins by explaining just what television is and how pictures are transmitted and reproduced. Without going into technicalities, he initiates the reader into some of the mysteries of the subject and touches on the present limitations and how they are being overcome by the introduction of new inventions and improved equipment. Production problems, both inside and outside the studio, are explained, and the reader is taken on the floor during a broadcast and the whole complicated procedure described in detail. The use and possibilities of film as opposed to "live" shows, the technique of outside broadcasts and the equipment used, relay systems and link-ups are all fully explained. Mr. Gorham, as a senior official, is also extremely aware of the administrative problems, and the work of the station manager, programme controller and the individual producer are all described in detail. This is a thrilling and absorbing book.

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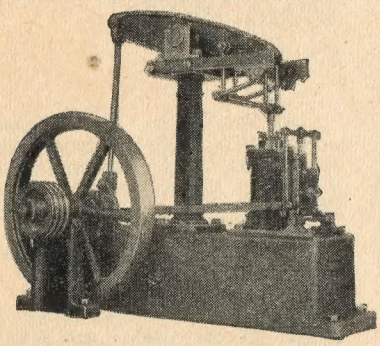

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Model Engineer Exhibition AUG 21-31

NEW HORTICULTURAL HALL, WESTMINSTER

PREVIEW OF ATTRACTIONS

Apart from the Competitions Section with its wide range of exhibits, including many wonderfully detailed working models, there will be an impressive array of attractions.

The live steam track will again be operated by the S.M.E.E. A full size model of a colour light signalling layout, 15 ft. 6 in. long by 2 ft. 8 in. wide, has been loaned by British Railways. So far, two model railway layouts have been lined up. The first is a "OO" gauge, size 22 ft. by 4 ft., which will be exhibited by Mr. F. A. Barrett of the Chingford and District Model Engineering Club. It has taken 15 years to build and contains a typical cathedral city railway station, with shops, cathedral, railway goods yard &c. The second is a model of the Emett "Oyster Creek" railway based on the prototype in the Royal Festival Gardens, Battersea Park. It is a 16.5 mm. three-rail layout and has been built by Mr. Anthony Jacobs and Mr. Barrie Deamer of the Chingford Club.

There will be demonstrations of all kinds of model engineering and workshop practice.

Visitors will see model car racing on a figure-of-eight track loaned by the North London Society of Model Engineers.

Demonstrations of radio-controlled and power-driven models will be given on the water tank.

The R.A.F. are giving a display which shows two high speed flying models of jet fighters which take off from a circular runway and fly independently at high speeds. There is a wind tunnel in which aircraft models can be tested for performance.

The British Electrical Development Association will be showing a number of working models to demonstrate the various uses of electricity in industry.

And, finally, there will be the wonderful model of the Paris Metro system presented to H.M. the Queen on the occasion of the Royal visit to the French capital.

THE "M.E." MUSICAL CLOCK

Readers of *Model Engineer* will recall the series of articles on the "M.E." Musical Clock which appeared recently. These were in effect a reconstruction of Mr. C. B. Reeve's own superb timepiece which he built to his own design between September 1951 and June 1952. The clock was entered in the Model Engineer Exhibition that year and was awarded the Bradbury-Winter Memorial Challenge Cup and a silver medal. The chimes were also recorded and broadcast by the B.B.C. Mr. Reeve took the clock to pieces for a short time in order to make the drawings for the series of articles. However, it has since been re-assembled and will be seen in the Loan Section. And also heard of course—there is a choice of two chimes and of four tunes.

Model Engineer

13 JUNE 1957 VOLUME 116 No 2925

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Published every Thursday

Incorporating SHIPS AND SHIP MODELS

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Steam car conversion: If there should be another petrol crisis. . . .

Centre finder

Simple aids to photography

Unusual locos

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Smoke Rings

A WEEKLY COMMENTARY BY VULCAN

AMONG the many small-gauge steam locomotives for which LBSC has been responsible, one of the best was the NER Class R1 4-4-0 No 750. Because of her number she was christened *Miss Ten-to-Eight*, and at the time of her introduction nearly 20 years ago, she won an immediate popularity.

During the war and the years that followed it, several excellent examples of this engine were built in different parts of the country, and they all gave satisfaction to their builders; and no wonder, because the engine at that time was about the largest, most handsome and powerful 4-4-0 available for 3½ in. gauge. The constructional features were reduced to the simplest possible for such an engine, and the result was a very good representation, in miniature, of the bold and massive-looking prototype.

The example described and illustrated by Mr Lewitt in this issue looks to be a very worthy addition to an already numerous family, and is interesting as a revival of an extremely popular favourite.

Exhibition entry forms

ENTRY forms for the 1957 Model Engineer Exhibition are now ready and may be obtained from the Exhibition Manager, 19-20 Noel Street, London, W.1.

An interesting feature which emerges from the newly printed conditions is that in the Railway Section, Classes B and C have been sub-divided. Class B is now for locomotives in gauges 1 and 0, and Class BA for locomotives in OO and smaller gauges. Similarly, Class C is for rolling stock and accessories in gauges 1 and O, and Class CA is for gauge OO and smaller.

A complete list of awards is given and they make imposing reading. A feature which was started last year and which was well appreciated was the issue of certificates to the owner of every model in the competitive sections.

A new award this year is a challenge cup presented by the directors of Aveling-Barford Ltd for the best model traction engine, road roller or steam wagon.

Unfinished models and loan models are also required and will be shown in the appropriate sections.

Entry forms and conditions of entry may be had from the Exhibition Manager, 19-20 Noel Street, London, W.1.

Perpetual motion

EVERY now and again, like the Loch Ness monster, the subject of perpetual motion breaks the surface of current thought and then plunges to limbo again, leaving us with the question: Can it be true ?

From the purely mechanical angle, it cannot. For any fourth form schoolboy will tell you that energy is required to maintain motion against

Smoke rings . . .

frictional losses and a machine that will function perpetually without an engine is just an idler's dream.

Yet perpetual motion has been achieved at least once, that is, if you are not too critical in your definitions !

I was glancing through an old volume of our stable companion *Home Mechanics*—it has been in existence well over a hundred years—when I came across reference to the "perpetual motion" clock exhibited at Cox's museum nearly 200 years ago.

The inventor claimed that it was driven by a "union of philosophic and mechanic" principles, and its source of energy remained a mystery until James Ferguson, the philospher, scrutinised it.

He discovered that its delicate jewelled movement was kept going by the fluctuation of a column of quicksilver in an incorporated barometer. Perpetual motion of a kind, surely ?

Model aids cadets

TO help his pupils get a better understanding of the intricacies of sailing ships, Sub.-Lt A. Buckland, of Hampton, Middx, built an elegant model of the famous grain clipper *Southern Cross*.

And there is no doubt that the model will be handled with particular reverence by the pupils, who are members of the Twickenham Sea Cadet Corps, for it was made from a piece of the hull of the original ship.

The model ship is 7 ft long and 5 ft high, and has 28 sails. Sub.-Lt Buckland, who is an officer of the Cadet Corps, says it is valued at £350.

"The giftie gie' us"

BURNS asked in a famous poem that some power might give us the gift of seeing ourselves as others see us. A recent inventor may be the benefactor Robbie was waiting for. I wonder if the makers of solid models will be interested in the automatic sculptor, the invention of George MacDonald Reid, of Marylebone, London. After all, you can reasonably compare a solid model to a piece of sculpture and it might save a good deal of time if the main part of the work was done mechanically and accurately.

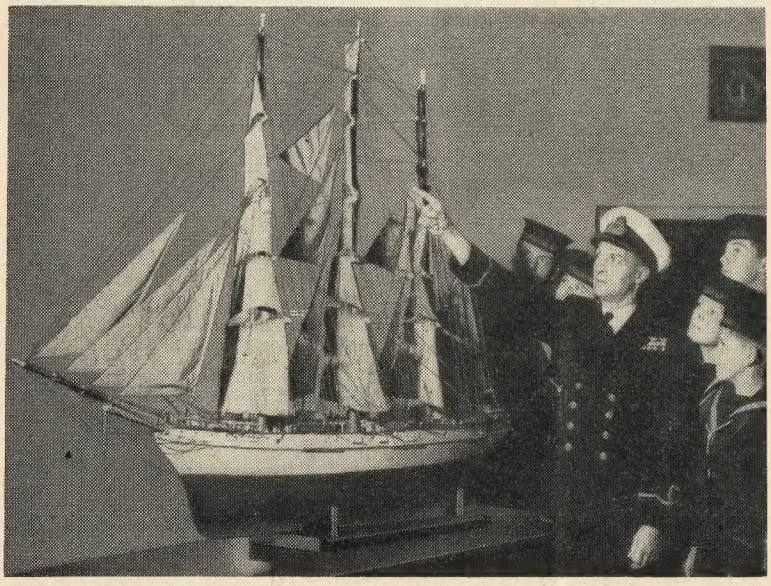
An article in the London *Evening Standard* describes what Mr Reid calls his "mechanical Epstein." The victim sits on a chair which makes one complete revolution while a camera device takes 300 separate profiles. The pictures are then projected on a screen *seriatim*. The profiles are traced by a pointer whose motion activates and controls an arm carrying a cutting needle, which carves away at the plaster former. After 300 operations the head is finished.

Uncanny accuracy

Mr Reid, bored with drawing caricatures of his pals in an Army mess, decided to build a machine capable of producing true likenesses. In a year after he was demobbed, he built the machine from scrap, wire and a Spitfire's camera. It sculpts with uncanny accuracy and, as Mr Reid says of the finished head, "Geographically it's you."

There seems to be a practical application here. Get out a deckchair and sit down with a little control panel on your lap. Make your model without moving out of the glorious sunshine. Let George—or George Reid's mechanical Epstein—do it ! But I suspect that readers will tread the well-worn path of made-by-hand in spite of Mr Reid's invention.

Sub.-Lt A. Buckland with the model he made to aid members of the Twickenham Sea Cadet Corps to grapple with the intricacies of sail



Cover picture

Two views of the high-speed marine engine described by J. H. Jepson on page 861.

Steam versus sail

HALFWAY through the last century the future of the steamship as an ocean-going cargo carrier was uncertain and, to many minds, unpromising. It seemed indeed that victory lay with the sailing ship.

The great difficulty was, of course, the steamship's heavy coal consumption. There seemed to be no adequate practical way of solving it until the compound engine was perfected and successfully incorporated in the steamship by Alfred Holt, of Liverpool.

This year, the 750th anniversary of Liverpool's first charter, makes a suitable occasion for remembering Alfred Holt and the Holt Fleet. They were remembered at the headquarters of Liverpool Nautical Research Society when Dr F. E. Hyde, Professor of Economic Science at the University of Liverpool, described the fortunes of the Holt Fleet.

Competition

Holt's success in challenging the clippers on the China and Pacific routes had the natural effect of encouraging others, and there followed an era of fierce competition with other lines in Britain and also with lines overseas. Freight rates fell and profits declined—yet Alfred Holt, despite his early initiative, set his face against the needed improvements.

Why is it that certain bold pioneers are, after a point, quite obstinately conservative ? Holt finally saved his fleet from disaster by helping to form one of the first big shipping conferences—but progress on the technical side was nonetheless inevitable.

In the Nineties, and again in the period from 1906 to 1914, the old Holt ships gave place to new, up-to-date vessels.

The MUNCASTER steam-engine models — 9

By Edgar T. Westbury (Continued from 30 May 1957, pages 778 to 480)

In the construction of models which have any pretensions to fidelity in respect of type or period, correctness is essential—not only in the general style and character of the main structure but also in the minor details and fittings. I have referred to this in earlier articles, but a further review of this matter may be desirable, especially in view of the errors which are often seen in model engines entered in exhibitions.

These models may be broadly classified as follow:

First, the type of engine which I have described as a "utility" engine. Many constructors wish simply to build an engine which will do a job, such as driving the screw propeller or paddles of a power boat or a stationary plant of any kind; they are not particularly worried as to whether it conforms to any particular period or style, and in many cases the engine works behind the scenes, where it is not visible or obtrusive. In such cases the only things that matter are functional efficiency and mechanical soundness.

Secondly, there is the freelance type of model which is intended to be generally representative of some period or phase of engine development, but not an exact copy of a prototype.

Thirdly, the true scale model of an actual full-size engine, whether period or contemporary type.

It is, in my opinion, the second class of model which presents the worst pitfalls to the unwary constructor because certain features in it must always be optional, and may be determined to some extent by simplicity or convenience. The discreet constructor of a true scale model will take pains to obtain authentic information about the actual prototype before he undertakes construction, and his task consists of making an accurate copy—at least in visible details. But in freelance models, not only may general design and proportions be at fault, but a model which is beyond criticism in these respects may be let down by small details.

Perhaps the worst kind of fault is an anachronism; that is, something obviously out of period, such as a "marine" type bolted crankhead bearing on an early nineteenth century beam engine. Another very serious fault in freelance models is to represent them as models of actual prototypes—ethically, this borders on the fraudulent—but it is often done! How often, for instance, have we seen alleged models of Stephenson's *Rocket* which bore only a very sketchy resemblance to this famous engine.

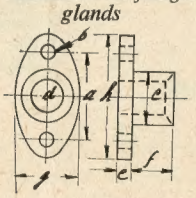
In Muncaster's models, the need to simplify construction never led him to commit crimes of this nature; both the general character and detail work in his designs were true to type and period though the use of certain ready-made parts, such as slotted-head screws, was allowed to a greater extent than I should consider permissible in a model intended for exhibition. These parts, however, could be changed without affecting actual component design.

GLANDS

Piston and valve rod glands are very simple components, but their appearance may make or mar a model.

d	a	b	c	e	f	g	h
3/32	3/8	1/16	7/32	3/32	1/8	9/32	9/16
1/8	7/16	1/16	1/4	3/32	5/32	5/16	5/8
5/32	17/32	3/32	5/16	1/8	3/16	3/8	25/32
3/16	19/32	3/32	3/8	1/8	7/32	7/16	7/8
1/4	3/4	1/8	1/2	5/32	5/16	9/16	1 1/16
5/16	7/8	5/32	9/16	5/32	3/8	11/16	1 5/16
3/8	1 1/16	3/16	5/8	3/16	7/16	13/16	1 9/16
7/16	1 1/8	3/16	11/16	1/4	1/2	7/8	1 5/8
1/2	1 3/8	1/4	13/16	1/4	9/16	1 1/16	1 3/4
9/16	1 7/16	1/4	7/8	1/4	5/8	1 1/8	1 7/8
5/8	1 1/2	1/4	15/16	9/32	11/16	1 3/16	2 3/16

Below, Fig. 42: Details of standard oval-flanged glands



In utility engines, screwed glands may be easiest to fit, and also to adjust in the limited space available. But most full-size engines have flanged and studded glands, the most common being the oval type as illustrated in Fig. 42 (the proportionate dimensions, to suit various sizes of rods, are given in the accompanying table).

Very large engines sometimes have circular-flanged glands, with three, four or more studs; the measurements, however, may be much the same, with the exception of the minor axis *g*. The internal bevel at the mouth of the spigot (shown in dotted lines on this drawing) acts as an internally inclined plane to wedge the packing towards the piston rod; an included angle of about 120 deg. (or normal drill-point angle) will be suitable—also for the counterbored gland recess or neck bush. This applies to either screwed or flanged glands.

BEARINGS

Several of the engines in this series have been shown with pedestal bearings of the split "plummer block" type, for bolting down to a flat base or entablature. The proportions of these are shown in Fig. 43, and the corresponding table.

In full-size practice, the bearing housings were often fitted with a rectangular bottom "brass," the fitting of which may be somewhat difficult in a model. Unless meticulous adherence to detail is considered necessary, a half-round brass may generally be regarded as suitable, if prevented from rotating by a peg or other means. In many cases, bushings may be omitted, and the shaft run direct in the pedestal casting, of cast iron or bronze.

An alternative type of main bearing, applicable where it is cast integral with the engine bedplate, is illustrated in Fig. 44. Here the horns of the housing extend well above the shaft centre, and are fitted with a keep plate, both the half-brasses being rectangular. The external shape of the cast keep plate shown in this illustration gives a much better appearance than the plain strip of steel bar so commonly fitted, and is also more rigid.

In many horizontal engines, pedestal bearings having both the split bushings and their housing set at an angle are employed, with the object of avoiding maximum thrust being taken on the dividing line; a typical example is seen in the Unicorn engine.

CONNECTING RODS

Various cross-sections of rods have been used in steam-engines; the earliest types had forged rods of round or rectangular section, but many classic examples of beam engines later had cast-iron rods of cruciform or

ribbed section. Still later, when machining facilities were improved, round and rectangular rods again became popular, but were now bright-finished all over. The bearings of these were usually of the "gib and cotter" type, at least at the crank-head, and often at the crosshead.

Two typical examples of these bearings are seen in Fig. 45; the first has a rectangular strap embracing the top and bottom sides of the rod end, and bolted in position. The split bearing is of rectangular shape to fit the frame thus formed, with side flanges for location, and the inner half has a tapered groove in the back so that it can be secured, or wear taken up, by a wedge or "cotter" which passes through slots in the strap.

In the second example, the strap is eliminated, the rod having an open-ended slot with a gap piece secured by a bolt. The wedge method is again employed for adjustment, but in this case is drawn in by means of a bolt against a tapered face in the rod itself. Many other variations of these bearings were used, but the same principle of adjustment was applied.

STOP VALVES

In many steam-engine models, realism is marred by the use of crudely-shaped auxiliary fittings, such as drain cocks or stop valves, which may serve their purpose but are quite out of keeping with the rest of the design. An example of a stop valve which is correct both internally and externally is shown in Fig. 46. It is best adapted for construction from castings, or at least one for the body, but could be fabricated or machined from the solid.

One or two important points about the funcional design may be noted; first, that the actual valve head is separate from the stem and free to rotate upon it, being retained in place by a tangential pin which intersects the groove in the stem. It may be made with a spherical curve outside, and also on the inside thrust face, as shown; this gives it a self-aligning property, though the "mitred" 90-deg. head and flat internal thrust face is more common.

Secondly, the valve seating in the body is raised, so that metal is available for re-facing if it becomes necessary, and grit or scale tends to fall away from the seating instead of remaining to become imbedded when the valve closes. Last, but not least, the threaded portion of the valve stem is made larger in diameter than the shank which passes through the gland, and a washer or neck bush prevents packing from jamming in the thread.

The main object of this form of design is to prevent any likelihood of the spindle being unscrewed out of the valve and getting blown into the face of the operator—not by any means an impossibility with some types of stop valves used in the past. These, I believe, have long been banned on full-size engines and boilers by Board of Trade regulations.

Both right-angled and straight-through types of stop valves are used on engines, according to convenience, the latter being more difficult to make in small sizes, though methods of doing so have been described several times in MODEL ENGINEER. In either type, the entry side should be under the valve head, so that the gland is not under pressure when the valve is closed.

REVERSING GEAR

It has already been mentioned that the majority of stationary engines are made to run in one direction only, as the need to reverse them simply does

d	a	bolts	b	c	h	l	f	g	e	j	k
3/16	3/8	1/16	7/16	5/16	3/16	1 1/16	15/32	7/8	11/32	21/32	3/32
1/4	7/16	3/32	1/2	7/16	1/4	1 11/32	19/32	1 3/32	7/16	27/32	3/32
5/16	1/2	3/32	9/16	1/2	5/16	1 7/16	11/16	1 3/16	9/16	15/16	1/8
3/8	9/16	1/8	21/32	5/8	3/8	1 3/4	13/16	1 7/16	5/8	1 1/8	5/32
7/16	5/8	5/32	23/32	3/4	7/16	2	7/8	1 11/16	11/16	1 5/16	5/32
1/2	5/8	5/32	3/4	7/8	1/2	2 3/8	1 1/16	1 15/16	13/16	1 1/2	3/16

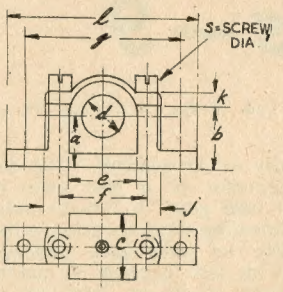
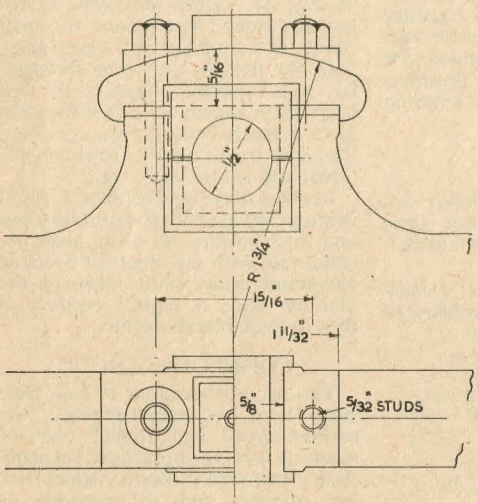
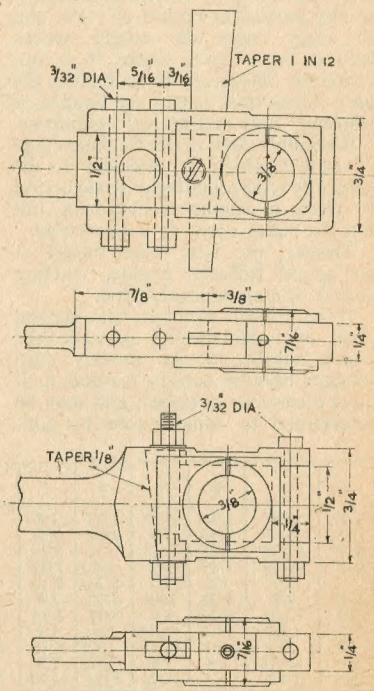


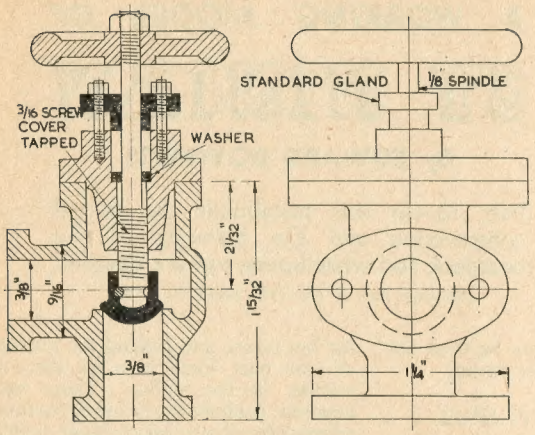
Fig. 43: Standard "Plummer block" type pedestal bearings



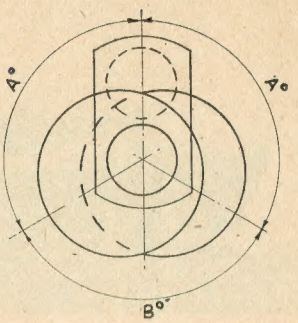
Left, Fig. 44: An alternative type of pedestal bearing, cast integral with the engine bedplate

Right, Fig. 45: Alternative types of "gib and cotter" connecting-rod bearings





Left, Fig. 46: A standard type of right-angled stop valve for the manual control of steam supply



Right, Fig. 47: Diagram showing the positions of eccentric in relation to crank, for forward and reverse rotation

not arise. Certain types of engines, however, such as those for hauling, hoisting or winding, need to be reversible—and this also applies to marine engines of all kinds.

In dealing with oscillating engines, it was seen that rotation can be reversed simply by changing over steam and exhaust connections, but this is not practicable in the normal type of slide-valve engine, especially if it is provided with lap and lead for efficient operation. A piston-valve engine with no lap or lead, however, can be reversed in this way, and it is often done on engines for small cranes, ash hoists and ships' steering gear, for the sake of simplicity and convenience. Generally, however, reversing entails shifting the phase of the valve gearing through an angle of 180 deg., minus twice the angle of advance.

This is illustrated in Fig. 47 which shows the positions of the eccentric, relative to the crankpin, for both directions of rotation. The exact angle, of course, will depend on the amount of lap and lead employed, and for an inside-admission piston valve the angle of advance will be on the minus side of 90 deg. from the crankpin in each case.

The simplest method of obtaining the required phase shift is by using a single eccentric, not rigidly fitted to the shaft but capable of a limited angle of movement, so as to take up the relative angles shown when moved to the limit of travel either way. With this arrangement, an engine once started in a given direction will automatically take up its correct timing so as to continue to run in that direction.

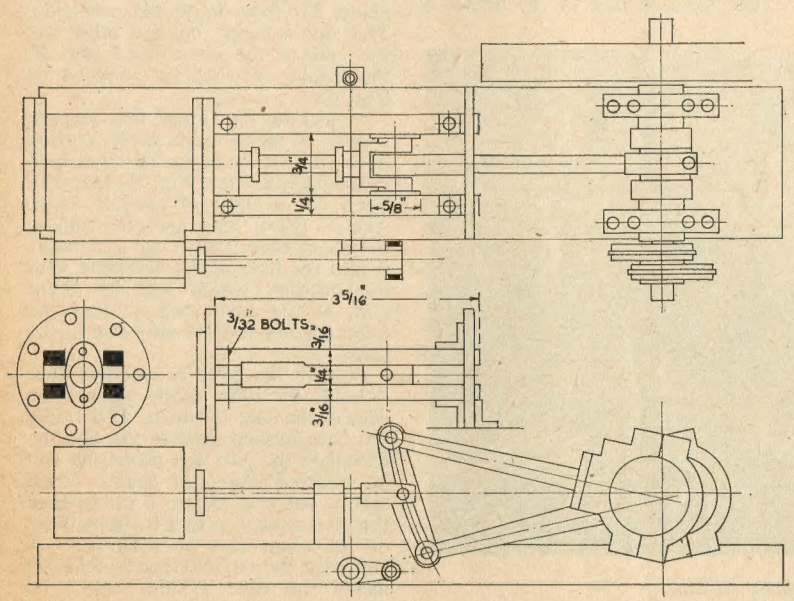
The " slip " eccentric, as it is called, is very popular for simple model locomotives and marine engines, and has also been applied to quite large engines in conjunction with some means of disconnecting the slide valve and operating it by hand for manoeuvring. Such engines are not positively self-starting but this applies to all single-cylinder engines in any case, and is not necessarily a practical disadvantage. A typical example is the Trojan marine engine.

There are several types of positive reversing gears used on steam engines, most (if not all) of them being designed not only to effect the required phase shift, but also to vary the admission cut-off, so as to employ expansion to best advantage—in other words, to " notch up," the notches being those in the reversing gear control quadrant. Of these, the earliest best known, and still most universally popular, is the so-called Stephenson link gear, though its title has often been held in dispute, and is sometimes ascribed to Howe, who was employed by George Stephenson.

Muncaster gives an example of a horizontal engine fitted with this form of link gear (Fig. 48) which may serve as a typical illustration of the general design and proportions of its working parts.

● *To be concluded*

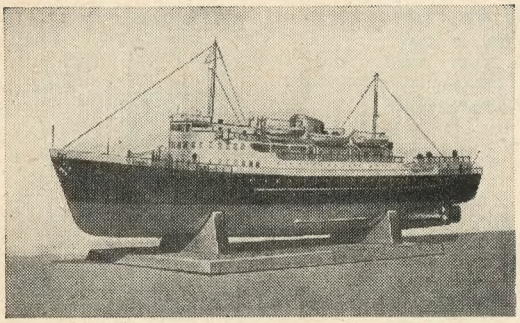
Fig. 48: A horizontal engine fitted with Stephenson link reversing gear



ADDITIONS TO THE LATHE

Instructions for making centring devices; chucking accessories; tool holders and cutter bars; dividing appliances; simple milling attachments; aids to screwcutting; and steadying appliances are to be found in Edgar T. Westbury's *Lathe Accessories.*

Priced 3s. 6d., postage 3d. (U.S.A. and Canada $1.00), it can be obtained from Percival Marshall and Co. Ltd, 19-20, Noel Street, London, W.1.



A WORKING MODEL OF ST NINIAN

By EDWARD BOWNESS

Part 12—In this instalment the funnel construction and the planking of the boatdeck and wheelhouse top are detailed

(Continued from 30 May 1957, pages 772 to 774)

IN building a ship model I must confess I like to see the ship growing as the work proceeds. I am not one of those people who like to make the " bits and pieces " and store them away until the final assembly. I prefer to see the model looking like the final result as early as possible. It is something like painting a picture. . . .

My idea is to rough it in first, getting the general proportions correct and the colour scheme roughly decided on, after which I can work away at it and gradually bring it up to any desired degree of finish.

To apply this to the model under construction I have now finished the main masses of the midship superstructure and, with this in position on the hull and the after deckhouse well advanced, the graceful form of the finished model begins to appear. To complete the general effect the funnel should be added. With this in position you will have something inspiring to look at, something which will stimulate your efforts to complete the model so that it can be tried out on the water and under steam.

MAKING THE FUNNEL

In *St Ninian* the funnel is short and squat and has the usual pear-shaped section with a pronounced rake. Modern funnel tops are sometimes a bit trying, but this one, I consider, is not at all obtrusive. In fact, it adds a finish to the funnel without which, being so short and broad, it would be rather harsh.

The funnel has no stays although a series of eyebolts around the top flange (see picture on page 845) seems to suggest that stays had been provided for. The rake of the funnel is $1\frac{3}{16}$ in. per foot, which means that in the model the upper edge of the parallel portion will be 0.3 in. aft of the lower at its height of 3 in. above the baseplate. The full dimensions of the funnel and cap are given in Figs 60 and 61. The section is given in the drawing of the baseplate (Fig. 56, May 30) and the funnel should be a tight fit in the hole.

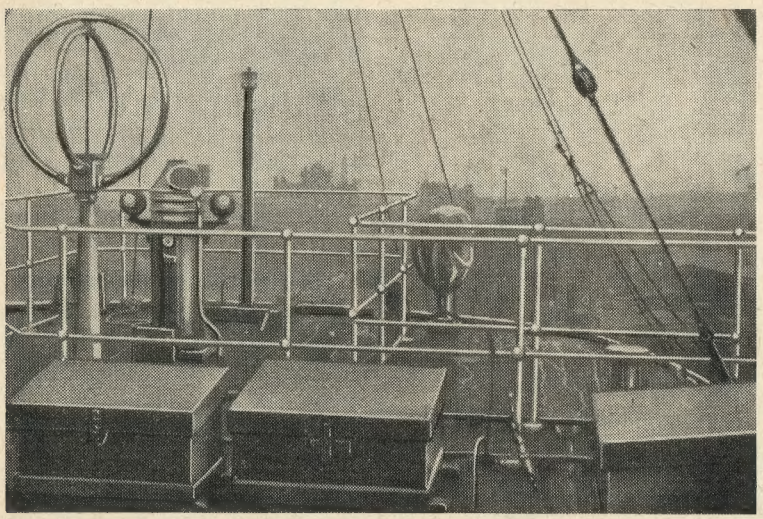
The forward half of the funnel is the fan room, and around the outside of this part there is a number of louvres in the walls. These are, however, confined to the lower portion, where they are to a great extent hidden by the lifeboats and, therefore, may be ignored in the model. On the starboard side of the funnel there is an iron block or sheave for the emergency aerial which comes down from the yard on the foremast, as will be seen in the picture already referred to.

Incidentally, in the foreground of this picture will be seen the deckhouse referred to in part 8 (April 18). The difference in the style of the windows as compared with those in the after end of the wheelhouse, which is seen just forward of the funnel, is obvious. The patchy appearance of the deck is due to the fact that it had been raining just before being photographed.

On the forward side of the funnel, about 3 ft below the top, there are two holes of 12 or 15 in. dia. One is on the centre line of the ship, and the other is spaced with its centre about 2 ft from it on the port side. This one is open, but the other has the bell of the siren fitted into it, the throat of which is about 4 or 5 in. dia.

In making the funnel first prepare a piece of wood or three-ply, cutting it to be an easy fit in the large hole in the baseplate (see Fig. 56, May 30). Then cut a sheet of tinplate $3\frac{1}{2}$ in. wide × $10\frac{1}{4}$ in. long, and after tinning the short ends, roll it up and insert it into the hole in the baseplate with the overlap, which will be about $\frac{1}{8}$ in. at the small end so that the outer edge is on the centre line of the ship.

Push in the piece of wood so that it holds the tube tightly against the edge of the hole all round. If the tube has been pushed halfway through the baseplate the part left projecting can be soldered along the seam. Then take it out and replace it in the hole the reverse way so that the remainder of the seam can be soldered. A stiffening plate should then be soldered inside the tube 1/32 in. below its



Open bridge on top of the weelhouse looking forward

upper edge. This should be a close fit in the tube and the centre should be cut away before fitting, leaving a width of about $\frac{1}{4}$ in. all round.

I imagine in *St Ninian* the funnel will be closed in with a plate through which the engine exhaust pipes and other pipes for escaping steam and fumes are led. However, I think it would be best to leave ours open for ventilation.

THE FUNNEL CAP

The cap of the funnel is in the form of a shallow cone. The shape of the strip required for making it can be laid out on the drawing board without too much trouble, and I imagine much more quickly and easily than by trial and error with a cardboard template. The method of laying out a cone is well known; simply use the hypotenuse of the cone as the radius, and make the length of the sector equal to the circumference of the cone. This particular funnel cap is composed of segments of four cones, one for the small radius, one for the large radius, and two for the still larger radii of the side pieces.

Its outline, when developed on a flat surface, is, therefore, a little more complex than that of a simple cone. However, it is not difficult if the problem is tackled methodically. First draw the plan of the funnel and, below it, the side elevation, showing the sloping sides of the cap, which are at 25 deg. to the vertical (see Fig. 61). Letter the views as shown. Ignore the depth of the cap at this stage, and confine your attention to the shape of its basic outline.

From *A* (Fig. 61), the centre of the small radius, draw a perpendicular to intersect the sloping line at *J*. *GJ* is the radius of the arc for the portion *CGF*. Similarly, from *B* draw a perpendicular to intersect the sloping line at *K*, which gives *HK* as the radius of the arc for the portion *DHE*. The radius for *C* to *D* and *E* to *F* is 4 in., which happens to be the same as the width of the funnel. Therefore, if you produce *G* vertically until it intersects the sloping line *HK*, produced, at *L*, *HL* will be the radius for the side portions *CD* and *EF*.

For convenience in making the strip, I have drawn the outline symmetrically about the centre line of the funnel, beginning at *H*, the forward centre line and the widest part of the strip. With centre *M* and radius *HK* draw the arc *DE* with the mid-point on the centre line. Produce *DM* to *N* making *DN* equal to *HL*. Draw radius *DC*, making its length equal to *DC* on the plan of the funnel. Join *CN* and on it mark off *CP* equal to *GJ*. Draw arc *CG* making its length equal to *CG* on the plan of the funnel.

On *GP* mark off *GQ*, the width of the strip on the after centre line of the funnel, and on *HM* mark off *HR*, the width of the strip on the forward centre line. A fair curve between points *Q* and *R*, giving a gradually tapering width to the strip, will show the outline for the port half of the cap. Repeating the process on the other side of the centre line will show the outline for the starboard half of the cap.

The tracing should now be pasted on a brass sheet, after which the strip can be cut out and trimmed accurately to shape. Bend the strip to fit the inside of the top of the funnel, when it will be found to lie flat and to have the correct inward slope all round. The after ends should meet in a neat butt joint. After soldering it in position the sloping surface can be trued with a file. If the tapering of the strip has not been done carefully it may need a little truing up.

To complete the funnel a length of 16 s.w.g. half-round brass wire should be soldered round its upper edge as shown in the enlarged section in Fig. 60. To erect the funnel it should be pushed into the hole in the baseplate (Fig. 56), given the correct rake when viewed from the side, and be perfectly upright when viewed from fore and aft. When all is correct run a fillet of solder all round the underside, and a smaller and neater fillet on the upper side.

STAIRS TO THE DINING SALOON

Before planking the decks, the holes in the boatdeck on either side of the wheelhouse must be attended to. These were referred to in part 11 (May 30). It was explained that they were for the stairs leading down to the dining saloon on the deck below. The stairs must be shown, as they are quite noticeable in the model—especially as they have a railing round the opening. But we cannot have water getting down into the space below, which is closed and cannot be drained.

I have, therefore, enclosed the stairs in a sort of box or trunk, one for each stair. These are shown in Fig. 62. The stair itself is fixed to the sloping side of the trunk, and as the other side slopes underneath away from the hole it is not noticeable. Under rainy or stormy conditions water might get into the trunk, but it can easily be dried out by using a sponge or by turning the model upside down.

A vertical flange $\frac{1}{8}$ in. deep runs round three sides of the opening. When soldering the trunks in position make sure that the joint at the deck is watertight, especially on the stair end where there is no flange. On the side which lies against the side of the wheelhouse the flange should be soldered to the side of the house.

The planking for the boatdeck and the deck which forms the top of the wheelhouse should now be laid. To begin with the boatdeck: when

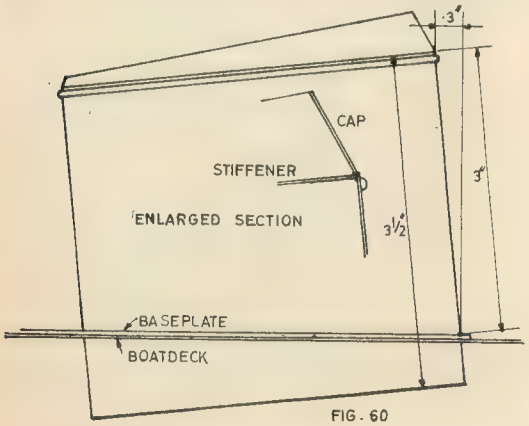


FIG. 60

Top: Looking forward along the starboard side of the boatdeck

Left, Fig. 60: Side elevation of the funnel showing rake

making the drawing for Fig. 38 (April 18) I intended to solder the rails for the davits to the deck, and to interrupt the deck planking where they rested on the deck. However, on further consideration I think it would be simpler and better to make the deck planking continuous as far as possible, and to bolt down the rails on top of the planking.

Consequently, the run of the butts at the ends of the planks should be continued right out to the sides of the decks. The sequence will be the same so it will be an easy matter for the builder to carry out the work on these lines. At each of the three stairways to the deck below, the planking will be interrupted, and the one at the after end of the deck which lies at an angle will call for some careful fitting. Note that in each of these openings there is a short strip for a sill at the head of the ladder.

Transverse rails will be seen on each side at the after side of the wings of the bridge. Gates with a swinging portion of the rail are also provided. As will be seen in the picture on page 630 (May 2) these rails are supported on pillars, and the planking is continuous underneath them. The same applies to the short rails on each side just forward of the two lifeboats on this deck.

In the drawing of this deck (Fig. 38, April 18) a framed hole is shown just aft of station 4. This is for a 12 in. mushroom ventilator, the diameter being, of course, the size of the pipe and not of the head. It will be noticed that this hole is on the port side of the centre line of the ship. A similar framing is seen around the hole for the mast. As already explained in part 7 (April 4) in connection with Fig. 36, this framing is very much of a refinement and could be ignored in a working model.

THE WHEELHOUSE TOP

The roof of the wheelhouse is planked like an ordinary deck, but the only portion of it which has any protecting railings is the passage from the head of the ladder and the portion which serves as an upper and open bridge (see picture on page 844). The rest of the deck has only a low curb, which in the model is represented by the edge of the sides of the house, which project about $\frac{1}{16}$ in. above the level of the planking.

The direction finder and standard compass are situated on this bridge, with a tall standard for the Morse signalling lamp on the forward edge. These fittings will be described later, but as they are in such a prominent position you might like to show the framing which is around the base of the direction finder, and also perhaps that around the base for the mast and those around the holes for the two mushroom ventilators further aft. These latter have trunks 17 in. dia., so are quite sizable affairs.

The picture shows the searchlight on the starboard side of the bridge and the cargo light on the port side. The searchlight is covered with canvas as it is not required while the ship is moored to the quay. The boxes in the foreground are for the storage of batteries. The peculiar lines on the deck are runnels of water from a shower which had just passed.

The planking is uninterrupted throughout this deck and, in its prominent position, gives the builder an opportunity of displaying his craftsmanship in both the neatness of his work and in his observance of the run of the butts, which is clearly shown on the drawing in Fig. 38 (April 18).

● *To be continued*

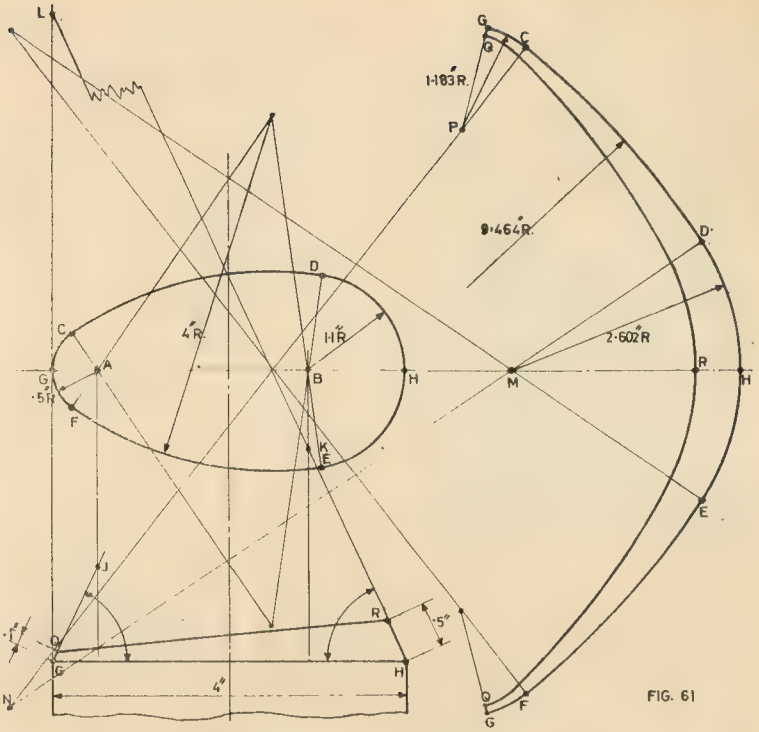


Fig. 61: Funnel and cap with the layout for the cap strip

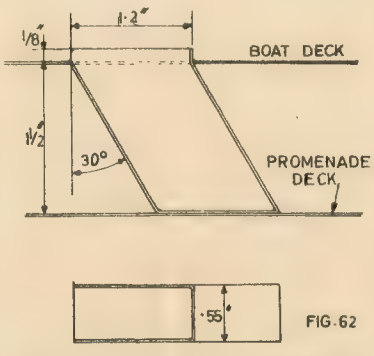


Fig. 62: Trunk for stair leading from the boatdeck to the dining saloon

TV CONVERTER DRAWINGS

A sheet of drawings for making a high quality cascode ITV converter is available in the Percival Marshall Plans Service. Construction of the converter was described in detail in *Home Mechanics*, our companion monthly magazine which is devoted to make-it-yourself articles. The sheet of drawings (Ref. G2) is available from the Plans Service, 19-20 Noel Street, London, W.1, price 3s. A limited number of copies of the May issue of *Home Mechanics*, in which the converter is described, is also available, price 1s. 3d. Instructions for building an ITV aerial were given in the February issue of *Home Mechanics*.

Machining simple connecting rods

AN ADVANTAGE of the single-web crankshaft with open crankpin—and of certain built-up types—is that the connecting rod can have a solid big-end eye, which simplifies its construction, makes for strength, and reduces bulk and weight—all important factors, and particularly so for high-speed engines and for two-stroke engines where dead space in the crankcase should be kept to a minimum.

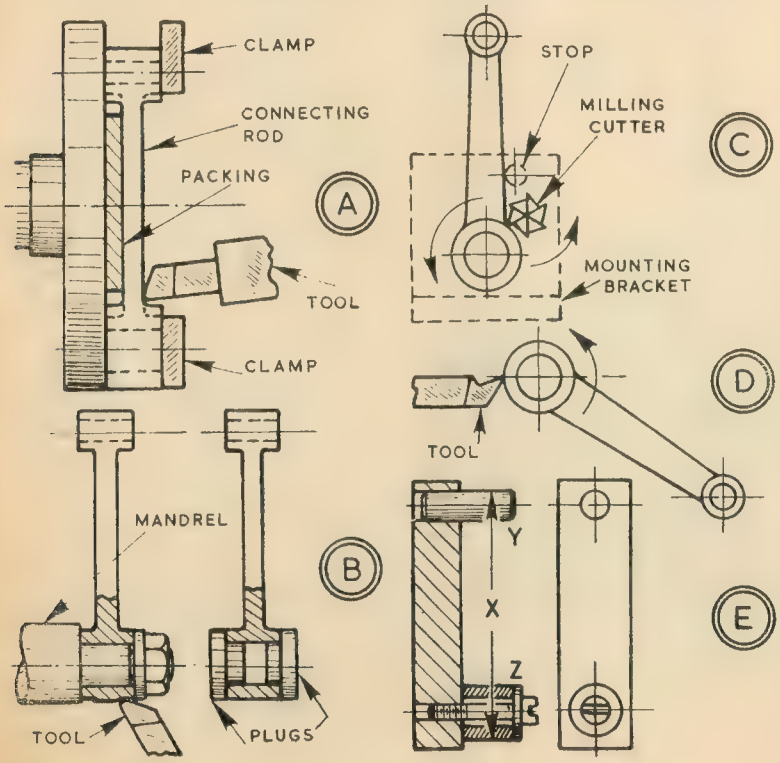
In the interest of reducing the weight of the connecting rod, while retaining a high degree of strength, duralumin is often used in model petrol engines, and in itself provides a good bearing on soft-steel or hard-steel gudgeon pins and crankpins. Steel may be used, but it is heavier, and the eyes require bushing with bronze, brass, or duralumin—except in some instances where the gudgeon pin may be a fixture in the small end and oscillate in the piston bosses.

Brass or bronze may also be used for the connecting rods of simple engines, of moderate speed and power, and both are heavier than steel, though neither requires bushing expressly, but only to facilitate overhaul when wear occurs, thus avoiding renewal of the whole connecting rod.

The simplest section for the length of a connecting rod is a rectangular one with rounded sides; and on a weight/strength basis it lacks little beside the familiar I-section, which is milled each side to leave a narrow central web. The connecting rod of rectangular section, however, can be entirely finished by turning methods—and some handwork—without the need for milling where there are no facilities for this.

Using a piece of suitable flat bar to make the connecting rod, it is faced flat one side by filing or machining a light cut, in the four-jaw chuck. Then the centres of small and big ends are marked, and these bores machined, clamping the bar to the lathe faceplate—preferably leaving the bores undersize for final finishing later by machining or reaming.

For machining the web, the bar is centralised and clamped, and facing cuts taken across. Final smoothing may be done with a file, with the bar removed; and for machining the opposite side of it, a piece of packing of appropriate thickness should be clamped against the faceplate, as at *A*, to provide support for the web.



Removing surplus material

The small-end and big-end bosses, which will be circular, can be produced partly by sawing and filing, partly by machining. Sawing and filing are recommended for removing the surplus material; and for holding the connecting rod securely in the vice without risk of damage, suitable hardened steel plugs should be made for each end, as at *B*. Following this, the connecting rod is mounted on a mandrel in the chuck (one mandrel for each end), and the bosses are turned back to the web—slightly tapering them towards the outside if required.

Surplus material along the edges of the web can also be removed by carefully sawing and filing; and eventually there will remain only material on the bosses in line with the web. Plugs can then be used as filing guides—particularly where the outside edges of the bosses are tapered, as with larger plugs, the file will clear except at the centre.

Alternatively, material in line with the web can be milled or "turned" off. For milling, as at *C*, the mill is run in the chuck, and the connecting rod mounted on a bracket on the topslide. A stop prevents the cutter gathering on to the web; with a light feed, the connecting rod is pulled round by hand. For "turning," as at *D*, the connecting rod is on a mandrel in the chuck, which is pulled round by hand for each cut.

Connecting rod centres may be accurately obtained, as at *E*, using a plug *Y* in one bore, for dimension *X* to be measured over a hollow "button" *Z*, which is then set to run truly for machining the other bore. ▣

A SUPER-SPEED STEAM TURBINE

This design for a model power boat unit should prove highly satisfactory for anyone contemplating such a project

By R. H. Mapplebeck

WHEN it was decided to look into the possibilities of making a working high-speed turbine for a model power-boat, it was considered advisable to read up previous articles on this subject.

Several have been published in MODEL ENGINEER by such experts as D. H. Chaddock and W. H. Elkin. They used the De Laval principle feeding dry steam to a nozzle directed on to specially shaped blades or teeth mounted at the periphery of a wheel. The power was transferred through a gearbox of substantial reduction to the working shaft.

It was difficult to believe the power claims of these exponents but with my own results before me, I bow to their wisdom. Through experimentation, I have come to learn that it is all quite true. However, in the turbine about to be described some problems in lubrication have had to be overcome on account of the high r.p.m. In fact, during tests, the rotor shaft seized up on several occasions.

Before going into constructional details here is a brief specification:

1 Rotor diameter: 1⅝ in. overhung from bearings
2 Gear ratio from rotor to power shaft: 25 to 1
3 Gear ratio from rotor to feed pumps: 625 to 1
4 Rotor shaft diameter: 3/32 in.
5 Maximum r.p.m. off load with 220 lb. of dry steam: 137,500 r.p.m.
6 Delivering 1/14 b.h.p. with 220 lb. dry steam: 97,500 r.p.m.
7 Delivering 1/9 b.h.p. with 220 lb. steam: 81,250 r.p.m.

The turbine was eventually tested up to 400 lb. pressure but with little increase in power. Maximum results appeared to be around 200 lb. with the present nozzle design. However, there is undoubtedly so much room for experiment that it would be idle to speculate on the possible effects of variations in design at the moment.

To obtain 1/9 b.h.p., a brake drum of 3 in. circumference was used, driven from the power shaft. This clocked 3,250 r.p.m. The static load was 2 lb., the spring balance read 6½ lb. when the turbine was running, giving a difference of 4½ lb. The power works out as:

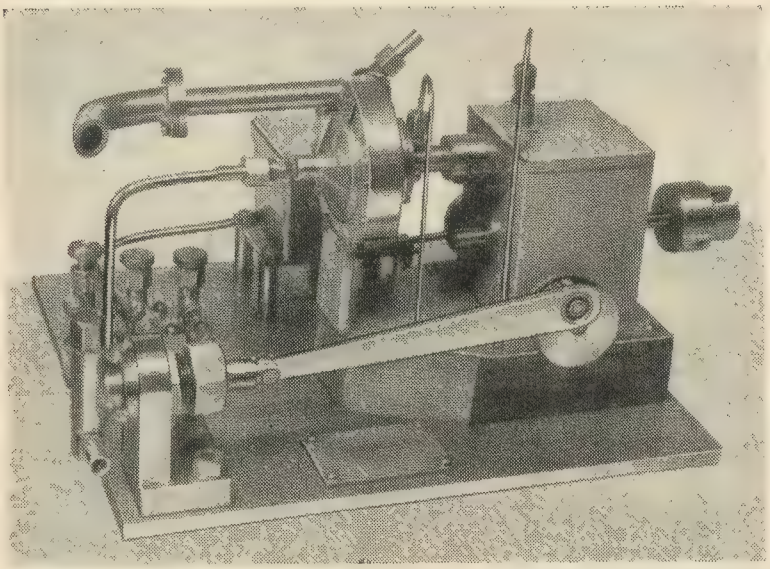
$$\frac{3{,}250 \times 4\frac{1}{2}}{4 \times 33{,}000} = 1/9 \text{ b.h.p.}$$

A point of interest is that at the full no-load r.p.m. of 137,500 the blades of the rotor are travelling at over 650 m.p.h. Internal stresses at these rotational speeds become prohibitive and serious thought was given to the choice of material. It was reasoned that as light a metal as possible combined with toughness was needed. So BS grade HE 15 WP duralumin was selected as being suitable. This was obtained in extruded bar and stress figures calculated.

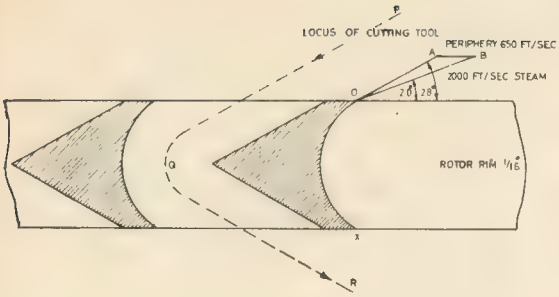
Centrifugal force at the rim worked out as 9.7 tons per sq. in. at 140,000 r.p.m. but the safe working stress of this material is 15 tons per sq. in. At these speeds, one milligramme of material is equivalent to about three kilos in centrifugal force. It can be understood then that unless the rotor is very carefully balanced, the slightest out-of-balance component will become vitally important and introduce such forces into the rotor as to restrict the r.p.m. to a comparatively low value.

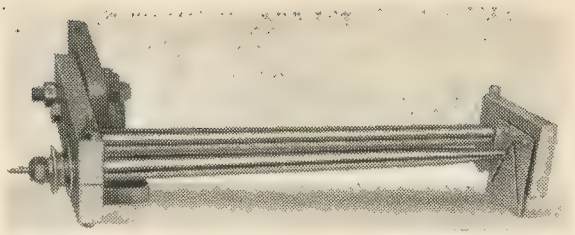
This was borne out by the initial tests. With 200 lb. of steam pressure it was not possible to go beyond a rotor speed of about 40,000 r.p.m. Increased pressure up to 400 lb. made little difference. It was thought at that time that this was the best speed obtainable, but on rebalancing the rotor very carefully I was astounded when the tachometer attached to the main shaft leapt to over the 4,000 r.p.m. mark. Multiplying this by the gear ratio of 25 to 1 gave a speed of over 100,000 r.p.m. !

The surge of joy was indescribable —but then I noticed that the gears were not turning. The brass split collet clamping the rotor to the shaft had come unscrewed and fallen apart. Another was made from steel, but this time the 3/32 in. hardened and polished steel shaft seized up in its phosphor-bronze bushes. Fortunately, no permanent damage resulted. But it has since been found



General view of the turbine with reduction gear and feed pump





Left: *Steam diagram. Angle of tool entry* = 28 *deg.*; ao *is tangential to* ox; *guide-plate groove is proportional to* pqr; *nozzle angle is* 20 *deg.*; *cutter is* 0.04 *in. D-bit*; *blades shown shaded*

advisable to allow some clearance here and provide forced lubrication.

The calculated steam consumption for the nozzle design finally selected worked out at 2.1 oz. per min. On actual test as near as could be ascertained from boiler feed water consumption, when the turbine was loaded up to 1/9 b.h.p. the boiler was evaporating about 2 oz. per min.

To get real power out of a turbine rotor of this description it *must* be properly designed. It is no use, for instance, cutting out a circle of brass sheet, bending the edges into teeth and mounting it in a boot-polish tin, as has been done. To begin with, the teeth or blades must be cut to the correct shape, the nozzle must have a properly-calculated venturi orifice, and a small nozzle clearance to blades is important. I used about 0.003 in. with 0.015 in. clearance between wheel and casting.

The steam consumed per horse-power hour should be about 30 lb. This means $\frac{30 \times 16}{9 \times 60}$ oz. for 1/9 b.h.p., which is about 0.9 oz. steam per min. But we have seen that the turbine used 2 oz. of steam per min., giving an approximate efficiency of 45 per cent. This seems good to me, but I am open to correction.

The starting torque is unbelievably high, and the whole unit can be held in the hand while running at full r.p.m.

A major drawback from a boat installation point of view is the size of boiler and blowlamp required, but the weight of these is compensated in part by the extreme lightness of the motive power unit itself. The weight of this as screwed on its base complete with pumps and control valves was only $2\frac{1}{2}$ lb. The boiler and blowlamp weighed 7 lb. together and the completed power plant on its baseboard weighed 14 lb. with water and fuel.

THE BLADE SHAPE

There were two items to be tackled before the rotor construction could be undertaken. One was to take pencil and graph paper and draw out the steam diagram and, from it, find the shape of the blades and hence the locus of the cutting tool that was to be used to machine them. The other was to fabricate the cutting tool. (See drawing illustrating typical rotor blade shapes on which is marked to scale the units of steam velocity when fed at an angle of 20 deg. to the plane of the rotor.) The rim velocity is equivalent to 100,000 r.p.m.

The line *OA* enters the curve of the blade *OX* tangentially, to which it is drawn. The dotted line indicates the locus of the 0.04 in. D-bit cutter as it traverses the rim, leaving the shaped portion to form the blades. This locus is the exact shape to which the copy plate for the tool guide must be made.

It was found that with a diameter of $1\frac{5}{8}$ in. 46 blades could be accommodated on the periphery of the rotor.

THE ENGRAVER

It is not proposed to go into constructional details of this quite simple attachment as details were given of a similar tool by Mr D. H. Chaddock in his articles [ME, December 1950/January 1951] The information there given was utilised and the result shown in the picture on this page As can be seen, by supporting the rotating arm with a self-aligning ball-race, the 0.04 in. D-bit will follow the correct path in reduced scale when the spindle is traversed over the copy-plate groove.

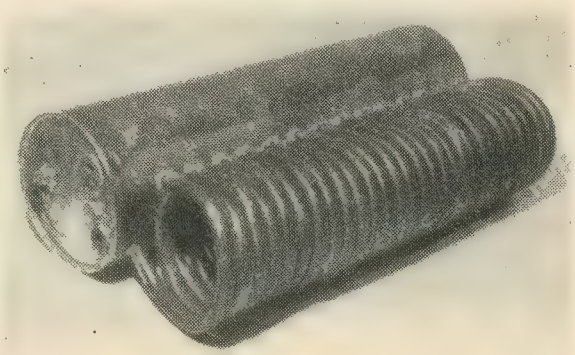
This is ten times larger than actual size, the rotating arm having been set in the ball-race to give a ten-to-one reduction to the cutter. Actual manipulation is with the fingers although the spindle is revolving at about 10,000 r.p.m. Power for this cutter was provided by a $\frac{1}{8}$ h.p. fractional motor screwed to the side of my shed workshop and a belt drive consisting of ordinary string. A large pulley was turned out of $\frac{3}{8}$ in. wood and fixed to the motor-drive shaft. While the set-up was available, two wheels were cut, one being set aside as a spare. It has not been needed—yet !

The dural bar was mounted in the three-jaw chuck and trimmed to $1\frac{5}{8}$ in. dia., then turned down either side of a ridge $\frac{1}{16}$ in. wide and $\frac{1}{16}$ in. deep. Excess material of 0.01 in. was left on the width of the ridge for trimming up after the blades had been cut.

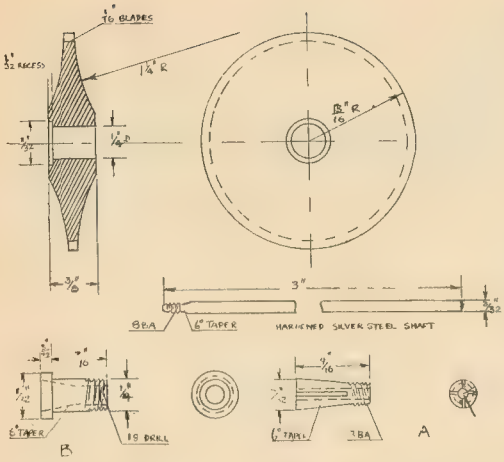
The engraver was clamped to an angle plate mounted on the cross-slide with the cutter lined up to the lathe centres.

With the lathe locked by means of a very makeshift dividing head and detent, the auxiliary motor was switched on and the first tooth cut in a matter of seconds. It was found that cuts of about 0.003 in. could be taken, moving the rotating cutter

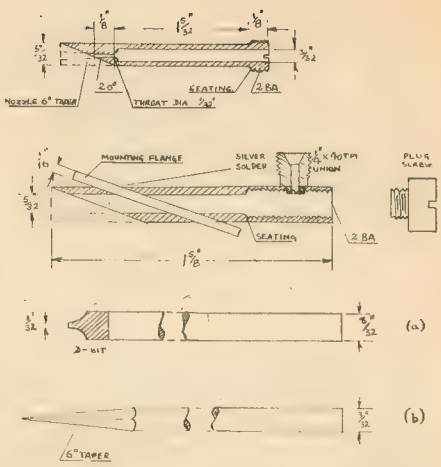
Top right: *The milling appliance for cutting the turbine blades*



Right: *The internal assembly of the water-tube boiler*



Left: Turbine rotor (duralumin) and the split collet (steel)



Right: The nozzle and nozzle holder (brass) and the taper reamers (hardened and tempered steel)

SUPER-SPEED STEAM TURBINE . . .

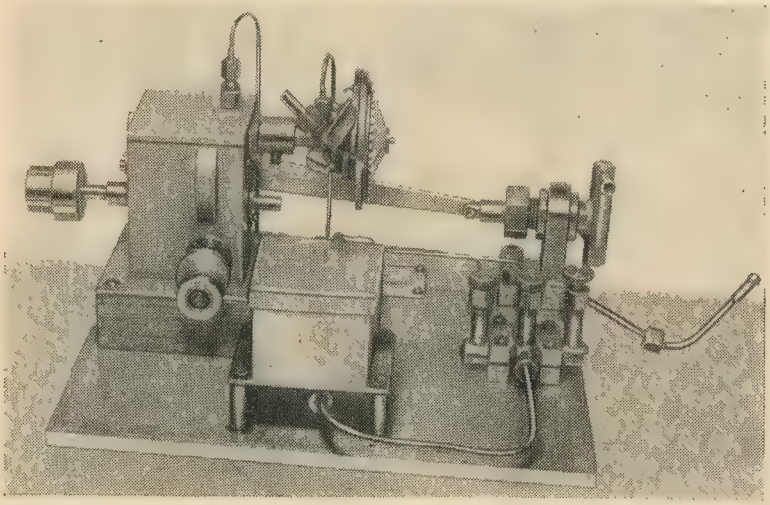
spindle follower along the copy-plate groove with one hand, and feeding in the cross-slide with the other.

Paraffin was used as a cutting lubricant, dabbed on with a child's paint brush and it proved adequate though considerable burrs were formed. This, of course, is not the correct lubricant, but as nothing else was to hand, it had to serve. Carrying on thus, all the teeth were cut in about half an hour, the engraver unbolted and removed, the burrs taken off and the blades trimmed with a very sharp tool.

Subsequently, it was found necessary to further trim up the blades individually, using the small blade of a penknife to scrape off minute burrs which only appeared formidable through a watchmaker's lens. The wheel was then parted off—with a hacksaw I regret to say—but not before the front had been carefully faced.

The next step was to mount the rotor for boring and shaping its profile. A piece of $\frac{1}{4}$ in. thick Bakelite (brass might be better) was clamped to the faceplate and a recess turned in it to give a nice tight fit to the rotor and blades when firmly pressed into it on the accurately faced side. The rough exposed side was faced down to a thickness of $\frac{3}{16}$ in. from a centre line through the plane of the wheel ridge forming the blades, then drilled and carefully bored out to $\frac{1}{4}$ in. A recess was turned at the centre 1/32 in. deep × 11/32 in. dia. to fit the spigot of the split collet on which it was to be mounted.

A piece of flat silver steel was ground up to form a round-nosed lathe tool, and a 4 BA hole drilled $1\frac{1}{4}$ in. from the tip. After hardening, this was mounted on a strip of heavy brass held in the toolpost, and so positioned that the surface of the wheel could be shaped by swivelling this handtool while feeding in with the cross-slide. This left $\frac{3}{8}$ in. of metal at the centre, reducing to $\frac{5}{16}$ in. at the rim. The wheel was reversed in the recess and held in position with a piece of 2 BA studding and nuts through the centre hole, and similarly faced and shaped on the other side. The finished wheel was then removed.



Side view of the turbine assembly with the rotor casing removed

THE COLLET

The collet is a straightforward job, but must be made accurately if the turbine rotor is to be free from eccentricity when running. The part marked *B* (see the drawing on this page) was rough-turned and threaded $\frac{1}{4} \times 40$ t.p.i., the hole accurately bored 3 BA clearance and tapered to 6 deg. Without altering the set angle of the cross-slide the part *A* was turned on a 3/32 in. stub mandrel, and the 3 BA thread cut, removed for slitting and replaced, mounting part *B* on it and tightening the 3 BA nut. It was then trimmed up to fit the $\frac{1}{4}$ in. rotor bore.

THE SHAFT

It is a difficult matter to harden a long thin steel shaft, but it must be done.

A 3 in. length of 3/32 in. silver steel rod was chucked. A short stub of one end was left projecting and turned down from 3/32 in. for threading 8 BA, then tapered 6 deg. from this thread to the full shaft diameter. On this was to be screwed the driving

pinion, locked with an 8 BA nut. This end of the shaft was rounded and polished, the other end left flat but polished.

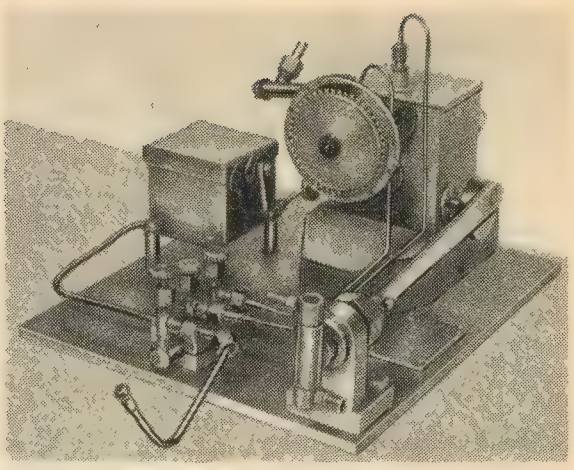
Now came the difficult job of hardening. I made at least six such spindles and used up all my 3/32 in. silver steel stock before obtaining one good spindle free of distortion. Someone advised me to place the spindle in the centre of a bundle of six such lengths tightly strapped together, heat the lot to cherry red and with cold water swirling in a jam jar quench the bundle by lowering vertically into the vortex.

Twice this was carried out and I was left with 14 wonderfully bent and distorted lengths of rod. Eventually a straight shaft was procured, probably by pure luck, by vertically quenching a single spindle at a time. (If anyone can inform me of a reliable method of hardening long thin spindles without distortion I should be grateful.) The ends were repolished as well as the whole spindle and let down to a light straw colour.

A delicate job

Any old pinion will not do for the rotor drive. It must be of high quality and of hardened or case-hardened steel such as obtained from a good clock movement. With a suitable pair of gears obtained having a ratio of 5 to 1 it was now time to drill and bore the taper in the drive pinion for mounting on the rotor shaft.

To do this, a piece of round brass stock was placed in the three-jaw and a recess bored out into which the pinion could be pressed. A small hole was drilled and enlarged with a specially made miniature boring tool to 8 BA tapping size, tapering a portion of the hole to 6 deg. Reversing the pinion in its recess and facing the other side completed this job. Anybody working on these lines is advised to obtain a case-hardened pinion with a soft core.



Another view of the turbine with the casing removed

The rotor was then assembled temporarily on the collet and spindle as a try-out for fitting into the gearbox. Gear No 2 with which No 1 pinion meshes was also of the same quality in steel with a ratio of 5 to 1. The remaining gears for which dimensions are given in the sketches, were purchased from Bonds o' Euston Road, London. Gear No 3 is also steel, meshed with No 4 in brass with a ratio of 5 to 1. On the shaft of this pinion was mounted the worm in steel, driving a brass wormwheel for the pump driving shaft. This gave a total reduction of 625 to 1.

I have since come to the conclusion that a faster pump action with a smaller ram would be better for obviating cyclic variations of turbine speed.

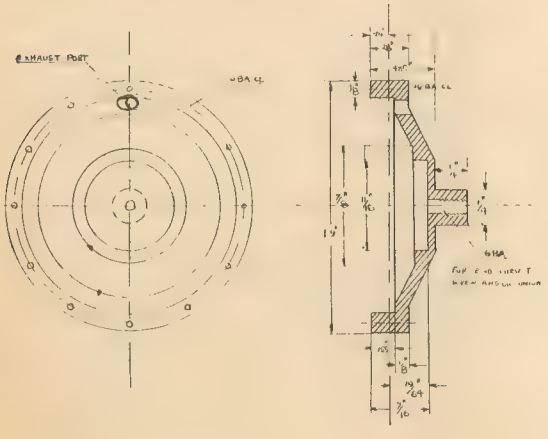
CASING AND BEARINGS

The casing and bearings are straightforward, details of which are gven in the drawings. The rotor bearing bushes were a press fit in the ¼ in. i.d. tube. The oil holes were drilled and tapped 4 BA to take the oil-pipe unions when the assembly was complete with the lid on the gearbox (which is a press-on fit) thus avoiding misalignment troubles.

When the rotor bushes were in position, the six fixing holes in the support tube flange were drilled 8 BA clearance and marked off on the case back for tapping 8 BA. Brass screws were used throughout. The only steel screws used were Allen type screws for clamping the bearing tube in position on the gearbox mounting flange and for securing the gearwheels and collars to the gearbox shafting.

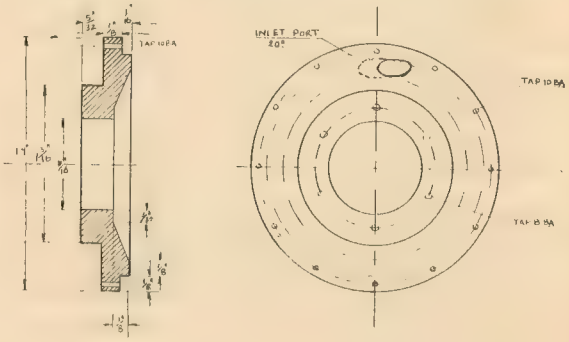
THE ROTOR FRONT BEARING

Considerable trouble was experienced through the front thrust bearing wearing out due to lack of lubrication. There is considerable friction at 100,000 r.p.m.

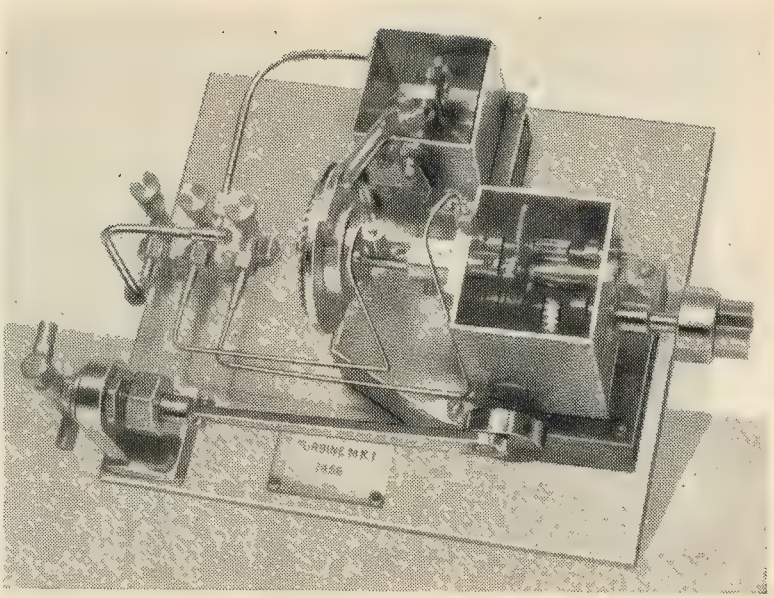


Left: Front of the casing (dural)

Below: Rear half of casing (dural)



SUPER-SPEED STEAM TURBINE . . .



View of the turbine with the gearbox cover removed

Adjustment of the rotor position relative to the nozzle is very critical, hence the use of an adjustable back stop and front thrust bearing screw. When the rotor was assembled with the gearbox, the backstop was set so that the rotor blades cleared the tip of the nozzle by about 0.003 in. The front bearing screw, which is a composite screw and union for supplying oil, was adjusted so that there was minimum rotor-spindle end play. The screw was hardened and the tip polished.

The hole through the centre which was made with an 80 drill, supplies oil directly to the bearing surface. It was the only way found to give adequate lubrication as at such high r.p.m. it is impossible to feed oil directly on to the thrust bearing. A $\frac{1}{16}$ in. steel ball was tried as a bearing surface, but it was worn flat in two minutes.

BALANCING THE ROTOR

One method of obtaining static balance of the rotor is to mount two knife edges on a perfectly level base and place the rotor and spindle on these. Provided the knife edges are level, the spindle will roll over and take up a position with the heaviest side downwards. Metal may be removed in very small amounts from this side by scraping or drilling small cavities and the procedure repeated until no movement takes place however the wheel is positioned.

Another method tried was to place the rotor in its bearings and holding in the hand allow the wheel to rotate by playing a jet of compressed air on the blades. The vibration of the out-of-balance component could be felt. A small piece of wax was stuck on different parts of the wheel in turn and the out-of-balance reduced and eventually eliminated by trial and error.

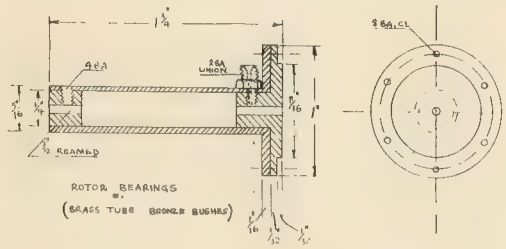
Metal was then scraped off as before, but on the opposite side to the wax, reducing the size of the wax until no further vibration was felt.

LUBRICATION

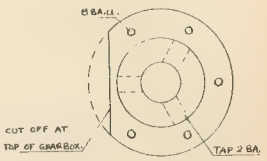
A *very* thin oil is recommended for the gearbox and bearings as a thick oil will retard the movement at high r.p.m. Enough oil was retained in the gearbox just to touch the pinion on the drive shaft which picked it up and transferred it to all other gears and, although it is immediately flung off the rotor pinion, it does receive sufficient lubrication owing to the extreme turbulence in the box while running.

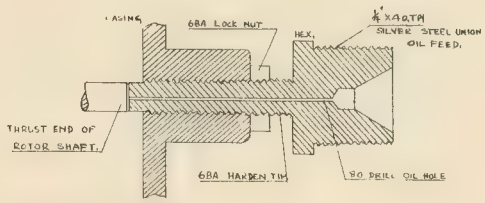
THE GEARBOX

Although details of gear sizes have been given, anyone attempting the construction of this item as shown may have to make modifications to suit

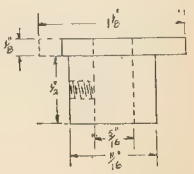


Left: *Oil feed to the rotor end bearing*





Right: *Rotor assembly mounting flange (brass)*



his own gear sizes. However, gears 3, 4, 5 and 6 are all obtainable from Bonds o' Euston Road, as already stated. Gears No 1 and No 2 were a pair of instrument gears that happened to be at hand.

The particular layout of the gears was chosen to occupy minimum space and yet leave the box symmetrically disposed about the rotor spindle axis in the horizontal plane. As a result, gear No 2 protruded through the side of the gearbox, but was provided with a coverplate as shown.

THE NOZZLE

The venturi was bored, using two special reamers. The one at *A* for shaping the back of the throat while the one at *B* (see the drawing, page 850) gave the correct taper of ten to one to the bore of the orifice. The centre line of the outlet of the nozzle should, of course, come exactly in line with the centre of the blades.

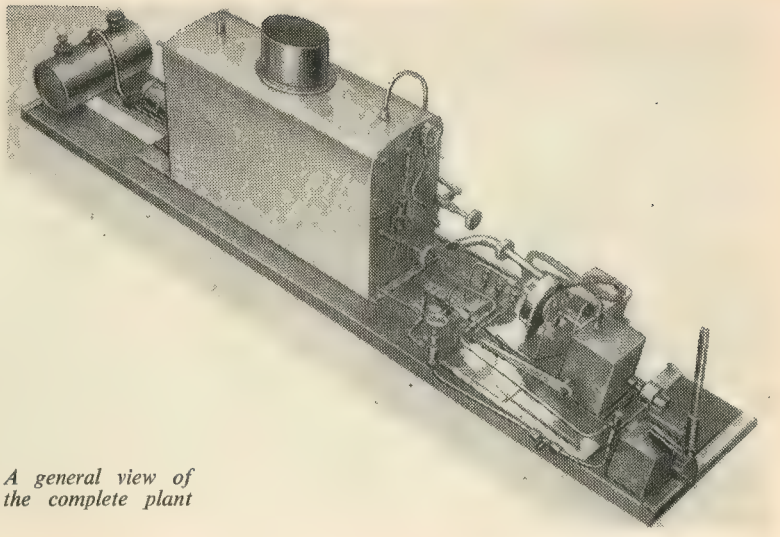
The nozzle-holder and mounting flange were arranged to supply dry steam to the blades of the rotor at an angle of 20 deg. as already explained. The nozzle itself was fitted by screwing it into the holder tube, the end of this tube being finally sealed with a 2 BA screw and asbestos washer. The nozzle was screwed down tightly on to the tapered part of the holder tube bore to make a steam-tight joint.

The end of the nozzle venturi was machined off flat and parallel to the plane of the rotor, i.e. at 20 deg. by mounting in the lathe the whole case with the jet completely assembled. It was found best to use the four-jaw for this.

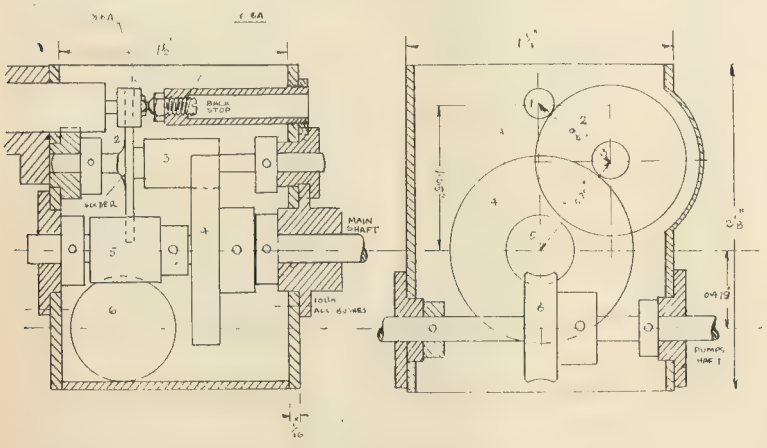
THE PUMPS

The oil pump is an LBSC locomotive lubricating pump and found to be most effective. No particulars are here given as dimensions may be had from many back numbers of LBSC designs or in the *Live Steam Book*. As an alternative, any very small crank-driven ram pump would be adequate. The three needle valves control the oil flow to the three force-lubricated bearings.

The water pump is of such a size that it will pump two oz. per minute, being the maximum amount of water evaporated for full load. The body of the pump has been machined from the solid for rigidity to withstand the thrust when working against a boiler pressure of some 200 lb. It will be noticed that on both pump cranks ball-races have been fitted to reduce frictional forces to a minimum. This is always worthwhile on any small power plant.



A general view of the complete plant



The gearbox. 1. (*wheel*) 0.2 *in.* (*dia pitch*); 2. 1.0 *in.*, 3. 0.25 *in.*; 4. 1.25 *in.*; 5. *and* 6. 0.479 *centres*

SUITABLE BOILER

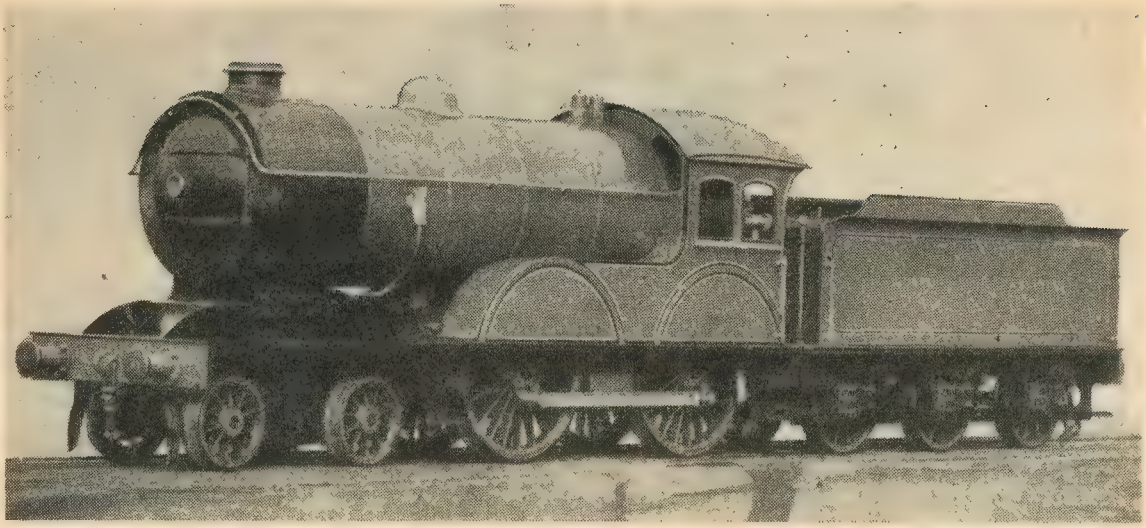
A really fast steaming boiler is needed for this turbine on account of the somewhat wide throat dimensions of the nozzle with consequent high steam consumption.

The boiler I used (see picture) is a Scott type. The drum is 3½ in. dia. × 10 in. long, with 14 tubes bent round a complete 2 in. circle and back again. One end is open for the application of heat from a fairly powerful blowtorch, the other end being completely blocked by asbestos sheet. Each tube has 1/32 in. gap between its neighbour, and the drum is unlagged. But the metal boiler casing is lagged completely. This design allows the hot gases to percolate through and around the tubes and over the drum before finally emerging (if any heat is left unabsorbed) from the central chimney flue. Nearly all the heat is absorbed from this type of boiler and a hand may be held close over the chimney without risk of burning. Each tube is $\frac{5}{16}$ in. o.d. giving a heating surface of about 1½ sq. ft.

It is hoped to have this plant installed in a 48 in. hull before the end of the season and put through its paces at regattas.

In conclusion

This project has proved to be a most interesting one—though there is undoubtedly much room for improvement. The design will be worked on and improved—I hope—in due course, and it is hoped that the data here given will encourage others to have a go at constructing a type of power unit that has been neglected of recent years. ▣



MISS TEN-TO-EIGHT

or 17 years of a locomotive's history by Max Lewitt, AMIEE

THE construction of this LBSC engine was begun as a first attempt in 1939, when the building notes first appeared. Nothing much more than the frames, wheels and boring the cylinder block had been tackled when the war began and work had to be suspended. A restart was made in 1943 and after a concentrated effort the engine moved under its own steam for the first time in 1945.

The running was limited to up and down 30 ft of floorboard with some ½ in. T-bar nailed to it for rails, with only house coal available as fuel.

At this time the engine was fitted with a spring-driven Intensifore cylinder lubricator mounted alongside the smokebox on the running board. A mechanical job had been tried but this only blew froth out of the tank when the regulator was opened.

No axle-driven pump or injector was fitted so the driver, or probably more correctly at this stage, the operator, had to spend his time waggling water into the boiler with the tender handpump and making trips to the front end to charge up the lubricator which always seemed to be at the empty end of the stroke.

A member of the newly formed local ME club had just made a locomotive testing stand and asked me if I would help to demonstrate the test stand at an indoor evening meeting. This seemed to be an ideal opportunity to see the wheels go round, which, for the reasons given below, was in fact all that did happen.

The test stand was well made and had a number of multi-gauge rollers adjustable to different engine wheel centres. The rollers were all connected by sprockets and chains and drove a generator for the purpose of applying load. But there was a snag. The generator was actually a series wound motor and electrically-minded readers can probably imagine that adjustment of load and speed was somewhat more than delicate.

Application of load generally resulted in the rollers and generator stalling, and due to the usual failure of tests beds, i.e. lack of adhesion, the engine went slipping merrily on.

The need for an axle-driven pump was realised and the addition of this was not easy on a four-coupled job with Joy's gear. However, with a bit of scheming and wangling, a plate stretcher was fitted above the guide bars and below the valve crossheads. This held the pump barrel and a slender valve box went neatly between the inner guide bars.

A split sheave in the middle of the crank-axle operated a fairly long eccentric rod and the pump ram was arranged to go right through into the vertical passage in the valve box. The pump is $\frac{5}{16}$ in. bore × $\frac{9}{16}$ in. stroke, and this may seem small when compared with some 3½ in. gaugers which are fitted with twin ½ in. × ½ in. pumps, but it will supply all the water required for hauling two loaded bogies continuously at full boiler pressure.

The mechanical lubricator was taken in hand, the gramophone spring ratchet idea was scrapped—because of excessive lost motion—and the standard 35 tooth ratchet wheel was fitted. After spending some time getting a good mating face on the cylinder and making a new 100 per cent tight delivery clack the lubricator was passed satisfactory when without fuss it would pump up to 450 p.s.i. This pressure could be left on and would take 12 hours to fall to 80 p.s.i.

The lubricator was attached above the main frame on the right-hand side just behind the smokebox and driven off the valve crosshead. It gets two teeth in full gear and one tooth in the normal notched-up running position.

In six years the lubricator has never given any trouble, but it did become suspect this last season when the tell-tale oil ring on the chimney top could not be observed and my spectacles remained transparent. The lubricator was removed and dismantled, the portface was a bit

scratchy and this was polished up.

The delivery pressure was as before but when refitted to the engine there was still no oil ring on the chimney top. The trouble was finally attributed to excessive sooting up of the chimney liner caused by using soft smoky coal for lighting up during the previous three weeks. This had been absorbing most of the oil and when the liner was decoked the oil ring returned.

The only fitting now missing was an injector, and with some trepidation, and against certain advice, one was made. It was not the actual one specified for this engine but a similar one for which a friend loaned a set of reamers. The injector was made in relatively record time, as I had access at this period to a 3 in. precision lathe with draw-in collets.

Injector cone trouble

This lathe ran fast and true and no drills or reamers were broken; the delivery cone I believe was drilled No 76. As first made, the injector would not feed, and four steam cones were tried before it did. The difficulty at the time was to know what to alter next and the clue was obtained from an ME of about 1934, where LBSC gave advice to someone making an injector for a 5 in. gauge job: "If steam blows out the overflow the steam cone is too long and if water pours out with full steam supply then the cone is too short."

Two of the cones had given these conditions, and these were checked for size and a few thou removed from the longer cone. Result—a dry feed from 80 to 40 p.s.i. with complete reliability.

As no continuous track was yet available, a testing stand was rigged up. This venture had two objectives, (*a*) to be able to watch the wheels go round, which was a very satisfying occupation in view of the number of years spent in construction, and (*b*) to do some performance tests.

This stand accommodated the engine and tender and was fitted with an electric tachometer, a shunt wound generator with switching for series or parallel excitation of the field coils, and a spring balance for drawbar pull. The no-load or friction loss of the rollers, etc., was determined approximately by motoring the generator and a curve was plotted of h.p. against speed and this was about $\frac{1}{8}$ h.p. at a scale speed of 200 m.p.h.

In operation this test bed had the same drawback as that mentioned previously, in that it was impossible to maintain adhesion on greasy rollers to give more than about $\frac{1}{8}$ h.p. output. Only if the rollers and wheels were continuously cleaned with carbon tetrachloride and additional weight hung on the boiler could this output be exceeded. As these measures savoured of cheating, the performance angle was dropped.

It was found, though, that even the $\frac{1}{8}$ h.p. no-load loss was quite sufficient to necessitate the engine being "driven" and quite a lot was learned about coal and water consumption and firing techniques.

Some passenger hauling was done at the local model engineer exhibition and the hard slogging entailed in hauling a concentrated load of young livestock up and down 50 ft of temporary track showed up errors in valve setting and, what was much worse, blowing pistons. The beat was uneven and could not be camouflaged by notching up and speed, and the amount of exhaust and noise would have done credit to a modern BR Class 5 backing the empty North Briton out of Glasgow Queen Street.

The error in the Joy's valve gear setting was not found to be serious and was solely due to incorrect axlebox positions.

The blowing pistons entailed a lot more work. As the locomotive had inside cylinders, the boiler had to be removed as well as most of the gear between the frames. The bores and pistons were scored and the clearance was about five thou. Only a few dried threads were left of the graphited yarn packing in the piston groove. The cylinder bores had been processed with a reamer, and though circular and parallel the surface finish was far from what it is now known to be obtainable by other means. It was obvious that the pistons had knocked off some high spots, hence the excessive clearance.

The method devised to clean up the bores was by lapping with a split wooden lap. This was 12 in. long and turned an easy fit in the bore with a 1 in. land a few thou bigger in diameter towards one end. The lap was split for nearly the whole length and adjusted by means of a tapered plug. The land was coated with a mixture of oil and rottenstone powder and the block floated over this with the lathe running fast.

This soon removed all but the deepest scores and cut surprisingly rapidly, the rate of cutting being easily measured by the temperature rise of the block. The surface finish was like glass and parallelism was checked by employing a number of quickly turned aluminium plug gauges.

New pistons were turned from stainless iron and were fitted with as little clearance as possible, just the slightest shake at the end of the piston rod. Some experiments were made to determine the width of a $\frac{3}{16}$ in. groove to ensure that a piece of nominal $\frac{3}{16}$ in. $\times$ $\frac{3}{16}$ in. packing would pack the groove really solid.

This overhaul took nearly 12 months and was just completed in time for the engine to appear in the next annual exhibition. It was set up and steamed and everything was satisfactory until the following evening when in attempting to move the engine a few inches along an exhibition stand it was found that the coupled wheels wouldn't turn.

This was indeed a very dismaying situation and the thought of another possible 12 months' work was rather demoralising when a quick check confirmed that both pistons were locked. In view of the complete freedom of the motion work on the previous evening, the problem was very puzzling. Steam was raised again, the engine was put in midgear and the regulator opened slightly at 50 p.s.i. boiler pressure and it was found that the wheels could be turned quite freely by hand. After a few more minutes' warming up, the engine was tried in full gear and ran freely.

In view of this freedom when hot it was decided to leave things alone and it was only after three years' track running that the engine could be pushed cold.

● *Continued on page* 870

The two views of MISS TEN-TO-EIGHT *were taken at the Tyneside Track, Exhibition Park*

LBSCR 2-2-2 'GROSVENOR'

No 35

By J. N. Maskelyne

IN my young days, the old London Brighton and South Coast Railway was still in possession of 26 very attractive 2-2-2 type express engines which were universally referred to as the "Stroudley singles."

They were great favourites among locomotive enthusiasts of those days, mainly because of the steady reliability of their work; years later, when I came to know some of the older drivers of the Brighton line, I discovered that these engines were well liked by the men who had charge of them.

Originally, the 26 engines had been divided into three separate classes, officially designated B, F and G; B and F each consisted of one engine only, while G was made up of 24 engines that were built about five years later than class F. Afterwards, all the 26 engines were put together under one class-letter G.

However, there is so much to record of the three original classes that I have decided to devote this and the next two articles to one class each; so this article deals with engine No 326, *Grosvenor*, originally class B, later B2.

She was built at Brighton in 1874, and for that period she was a very fine engine, one of the largest of her type in the country, and every detail of her design was, at least, right up to date if not actually in advance of the times. With it all, she was a stately engine, a real aristocrat, and she was loved by all who knew her. Even in my time, she worked crack express trains, mostly Portsmouth trains, though she often worked some to Brighton and Eastbourne.

I always associate her with that most amusing collection of headboards which signified "Victoria to Eastbourne via Quarry Tunnel." This consisted of a plain white disc above the left-hand buffer, another, often a square-shaped board, with a pair of horizontal parallel black lines on it set over the middle of the bufferbeam, and a third with a black, vertical cross mounted above the right-hand buffer. To all and sundry, this glorious combination, read across the bufferbeam, announced that "nothing equals plus."

All the best Eastbourne and Hastings trains carried it, and it usually raised a smile. *Grosvenor* was the first engine on which I noticed it, one afternoon, as she approached sedately towards me at the head of a long train passing Wandsworth Common, and I do not think that a more intriguing headcode was ever seen. The discs were 15 in. dia.

Incidentally, it was *Grosvenor* that worked the first through train from London to Portsmouth on 13 August 1875; the train was a Royal special conveying the then Prince and Princess of Wales (afterwards King Edward VII and Queen Alexandra) to a naval occasion. The 87 miles from Victoria to Portsmouth were run in 110 minutes at an average speed of 48 m.p.h.

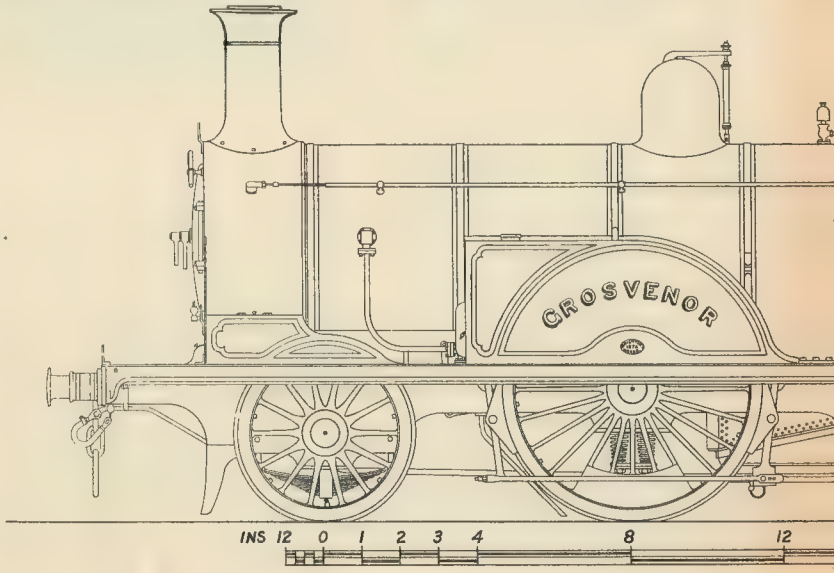
Two months earlier, however, this fine engine was her owners' representative at Newark, where some trials of various braking systems were held. She had an unusual arrangement of two brakes, one steam and the other hand-operated, in the cab, immediately accessible to the driver. In addition, the tender was equipped with the normal handbrake operated by the fireman.

As a result of the Newark trials, the LBSCR decided to adopt the expensive, but very effective, Westinghouse air brake, which remained standard practice at Brighton ever after It was one of the first of the continuous, automatic power-operated brakes, operating throughout the length of the train as well as on the engine, regardless of the number of vehicles in the train

Originally, the brake rigging on *Grosvenor* included two massive wooden shoes per side, working on the driving and trailing wheels; but at a later date this was altered to the clasp arrangement with cast-iron shoes on the driving wheels only, as seen in the drawing

For some time, *Grosvenor* worked the heavy 5.0 p.m. train from Victoria to Brighton, with its numerous company of regular season-ticket holders returning home from business, and taking 70 min. on the journey. At that period, she was stationed at Brighton; later, she was moved to Battersea and became what today we should call a popular star; everybody seemed to know her. She was never rebuilt, and was withdrawn early in 1907, after running a total of 1,048,000 miles.

Her principal dimensions were: cylinders, 17 in. dia. × 24 in. stroke; they were placed at 26 in. between centres, with the steamchest, 4½ in. wide, between them, set vertically. The ports were 1½ in. and 2 in. wide, respectively, for admission and exhaust; their extreme length was 15 in., but they were divided on the horizontal centre line so as to form two sets of



LOCOMOTIVES I HAVE KNOWN

ports, upper and lower, per cylinder. The valves had $\frac{7}{8}$ in. steam lap and $\frac{1}{8}$ in. exhaust lap, and were set with $\frac{1}{8}$ in. lead; their travel in full gear was 4 in.

An interesting feature was the placing of the whole group of ports $1\frac{3}{4}$ in. ahead of the vertical centre line through the steamchest, viewed in side elevation. The effect of this was that the length of the back steam passage, from port face to cylinder bore, was $3\frac{1}{2}$ in. greater than that of the front steam passage; but the idea was to compensate for the inequality of the admission periods, due to the angularity of the connecting rods, and to ensure the supply of equal volumes of steam to the front and back of each cylinder. Lever reverse was employed.

The boiler was made in three rings, 4 ft 3 in., 4 ft 4 in. and 4 ft 5 in. dia., respectively; the length of the barrel was 10 ft 5 in. and its pitch was 7 ft $3\frac{1}{2}$ in. The firebox casing was 6 ft $2\frac{1}{4}$ in. long × 4 ft 1 in. wide, and the grate area was 19.3 sq. ft. There were 206 tubes of $1\frac{3}{4}$ in. dia., providing 1,022 sq. ft of heating surface, to which the firebox added 110 sq. ft, making the total 1,132 sq. ft.

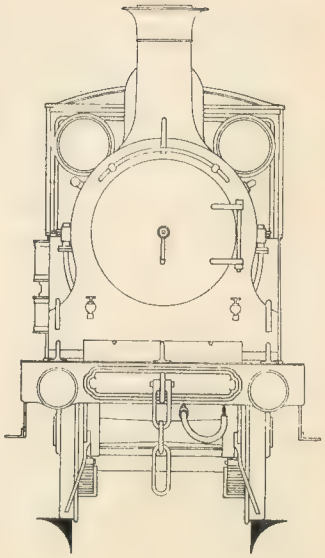
The driving wheels were the largest ever used by Stroudley, 6 ft 9 in. dia., and the leading, trailing and tender wheels were all 4 ft 6 in. dia., after the standard passenger tender shown in the drawing had been substituted for the smaller outside-framed tender originally fitted.

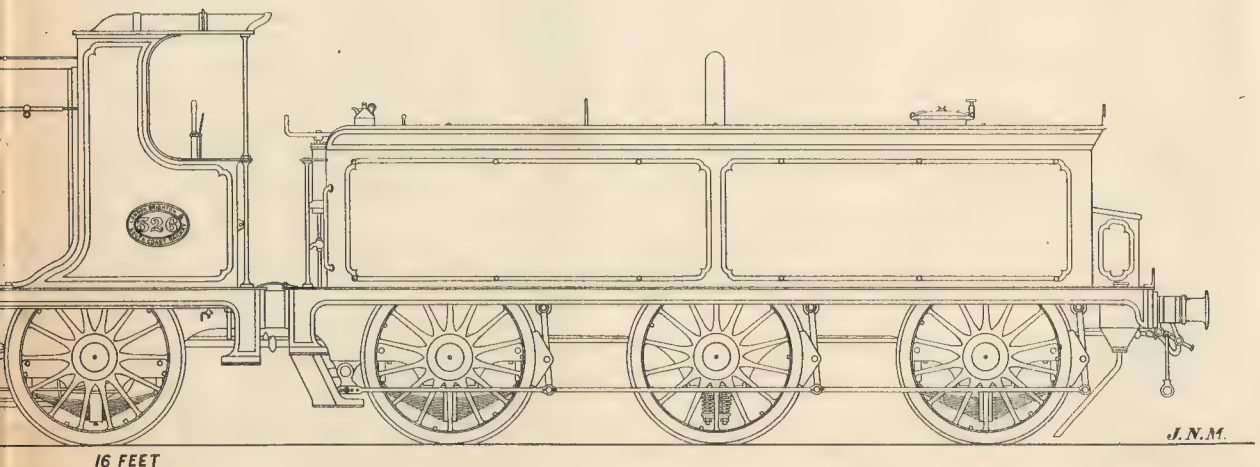
Grosvenor's wheelbase was 8 ft plus 7 ft 9 in., with overhang of 5 ft $8\frac{1}{4}$ in. at the front and 3 ft $8\frac{1}{4}$ in. at the back. The tender wheelbase was 14 ft equally divided, with overhang of 4 ft 2 in. at each end. The width of the engine footplating was 7 ft 2 in. while that of the tender was 7 ft 6 in. The cab and tender body were both 6 ft $0\frac{1}{2}$ in. wide outside.

The tractive effort, calculated at 85 per cent. of the 150 lb. boiler pressure and with 14 tons on the driving wheels, was 10,918 lb. Here, undoubtedly, was a fine engine, quite a landmark in the history and development of locomotive design; yet no more exactly like her were ever built. Her original number was 151, which was altered to 326 in 1880.

In 1907, the year when this fine engine was withdrawn, a story got about that she, together with two of the G-class proper, had been sold to the Italian State Railways. Two years or so later this tale was augmented by another rumour that *Grosvenor* was destroyed in the great earthquake at Messina in December 1908.

In 1926, I made very careful enquiries through the ISR offices in London, but no trace could be found of any information that could account for the story; but there is a very detailed account of the subsequent history of 40 Midland Railway 0-6-0s that were sold to Italy a few years prior to 1907. For this reason, I discredit the tale about the Brighton engines. ▣





ZOE

LBSC deals with the leading and trailing pony trucks this week, followed by some hints on a double-size version of this 2-8-2 engine

BOTH leading and trailing trucks have rigid frames and sprung axleboxes. In days gone by I sometimes specified fixed axleboxes, and sprung the complete frame, with the idea of letting the whole lot adjust itself to any unevenness in the track and going wherever it wanted. I found when running at high speed, it usually wanted to run off the road, so *that* idea was soon abandoned ! This type holds the road like a motor car with independent springing.

Both frames may either be built-up or cast. If castings are available—and I expect that they will be—the job will be as easy as eating cake, as the frames, rubbing-plate, horncheeks, pivot blocks, spring-pockets on the leading truck and dummy springs on the trailing truck will all be cast integral, and probably the end stay-bars also. The only work needed will be to turn and fit the kingpins, fit the guard-irons and axleboxes, and turn and fit the wheels and axles. Incidentally, the leading truck of my 3½ in. gauge 2-6-2 is a casting, and it was completed and erected in a single evening. The same casting would do for the double-size *Zoe*.

The frame plates of the built-up trucks are cut from $\frac{1}{16}$ in. sheet steel, in the same way as the main frames were cut. All the necessary dimensions will be found on the drawings, and if the frames when parted are bent on the dotted lines, it will be found that the axlebox and kingpin centres will come out approximately correct. There is no need to bother about " mike " measurements !

To assemble the leading truck frame, first cut out the rubbing-plate which bears against the underside of the bolster on the main frame. The narrow end of this is thickened up by riveting a $\frac{1}{2}$ in. × $\frac{5}{8}$ in. piece of 3/32 in. steel to it, which will form the pivot block. Then cut out the guard-irons and turn the front stay. Put the guard-irons on the pips at the ends of the stay, then put the frames over them (see plan) and rivet the ends of the pips into the countersunk holes. Next fit the rubbing-plate at the narrow end, flush with the upper edges of the frames, and hold it in place with one of those rough home-made cramps I mentioned some time ago, placed across the end. Don't use a regular toolmaker's cramp or it will be ruined by the brazing job.

Braze the rubbing-plate in place from the underside of the assembly; merely lay it in the pan on the coke or breeze, put wet flux along the edges, heat to bright red and apply a piece of soft brass wire, or a $\frac{1}{16}$ in. Sifbronze rod, to the joints, letting enough run in to form a fillet. This operation will attach the thickening piece permanently to the plate as well.

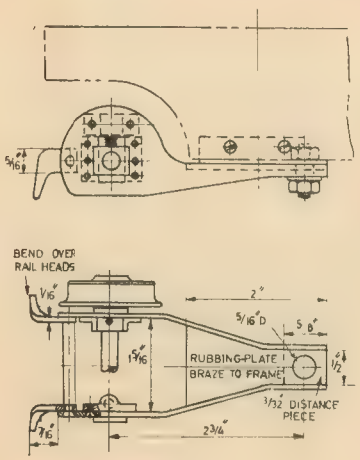
At the same time give the ends of the guard-irons a dose of the same medicine where they bear against the frames, which will prevent them from shifting if the engine should hit anything lying on the line while it is pulling a heavy load. Quench in clean cold water, clean up, file the rivet-head off the thickening-piece, and drill a $\frac{5}{16}$ in. hole through it for the kingpin.

The horncheeks are $\frac{5}{8}$ in. lengths of $\frac{1}{4}$ in. × $\frac{1}{16}$ in. brass angle with one of the angles filed off to a width of $\frac{3}{16}$ in. and are riveted to the inside of the frames flush with the sides of the axlebox openings, using $\frac{1}{16}$ in. brass or iron rivets. Drill the rivet holes in the frame first, and countersink them on the outside, then clamp the horncheeks in place with a toolmaker's cramp, drill through and rivet up, hammering the shanks well into the countersinks and filing flush.

The spring pockets are made from two $\frac{3}{4}$ in. lengths of $\frac{5}{16}$ in. square brass rod. File to the shape shown and drill the blind hole for the spring, then clamp in place on the inner side of the frame over the axlebox opening. Make countersinks on the ends with a No 41 drill put through the holes in the frame, follow with No 48, tap 3/32 in. or 7 BA and put countersunk screws in.

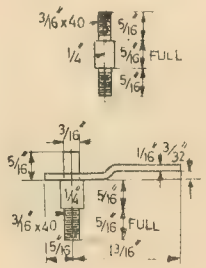
The axleboxes are made from $\frac{1}{2}$ in. × $\frac{5}{16}$ in. bronze or gunmetal rod (don't use soft brass or they won't last the proverbial five minutes) to the given sizes, by the same process as the main axleboxes described last week. Before inserting them into the openings, with the flanges outside, wind up a couple of springs from 22-gauge tinned steel wire around a piece of 3/32 in. steel, and put them in the pockets. They should just start to compress when the axleboxes are at the lowest position, at the bottom of the openings.

Turn four wheels while on the job, as both leading and trailing pony wheels are the same size. The process is exactly as described for coupled wheels, and the same applies to the axle. Press on one wheel, poke the axle through the boxes and press on the other, taking care to avoid splitting the boss. If the axleboxes have been drilled—there is no need to ream them—the wheels should spin freely in any position of the boxes, which is necessary on an uneven line. Most back-garden lines bear little

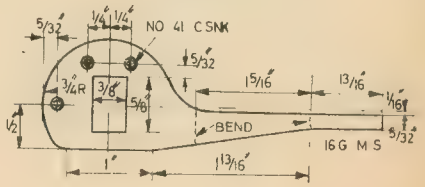


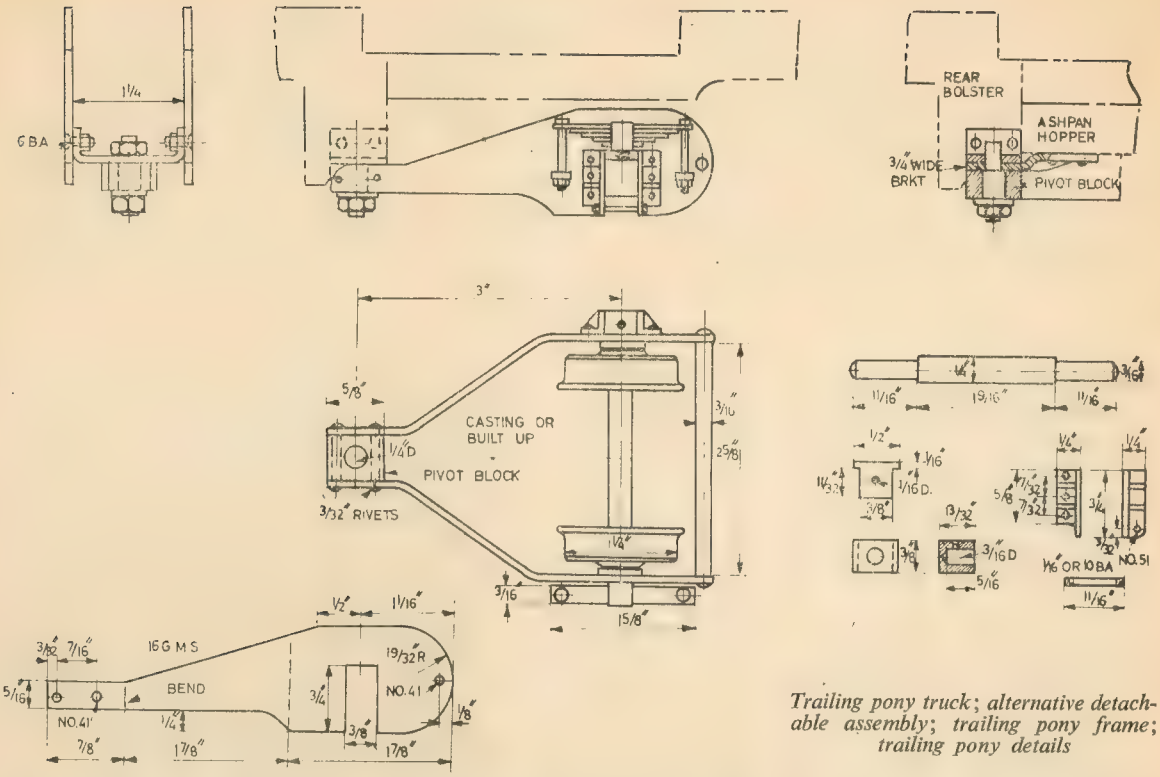
Left: *Leading pony truck*

Below: *Trailing kingpins*



Leading pony frame





Trailing pony truck; alternative detachable assembly; trailing pony frame; trailing pony details

resemblance to the surface of a billiard table !

The ends of the guard-irons are bent so that when the engine is on the rails they come exactly over the centre line of the railheads. The kingpin is turned from a piece of $\frac{5}{16}$ in. round mild steel held in the chuck, and needs no detailing. One end goes through the hole in the bolster and is nutted on top of it; the hole in the end of the pony truck should be an easy fit on the $\frac{5}{16}$ in. section and be perfectly free to swing when the lower nut is tight against the $\frac{1}{4}$ in. commercial washer. Make the nuts from $\frac{3}{8}$ in. hexagon steel.

On this kind of job, the fine thread specified is preferable to standard Whitworth pitch, being much less liable to work loose.

TRAILING PONY TRUCK

Although the trailing truck has outside bearings, the construction is pretty much the same, but no brazing is required, as there is no rubbing-plate. The pivot block is made from a piece of bronze or gunmetal $\frac{5}{8}$ in. long, $\frac{1}{2}$ in. wide and $\frac{5}{16}$ in. thick. First cut out the frames from 16-gauge steel to the given dimensions, then bend to shape shown in the plan; note that the slots for the axleboxes are open at the bottom.

The horncheeks may be made from $\frac{1}{4}$ in. $\times$ $\frac{1}{16}$ in. angle, in which case there is no need to bother about the triangular webs in the corners, or they may be cast; either kind can be attached to the frames by $\frac{1}{16}$ in. rivets, flush with the axlebox openings, before assembling the frames.

The leaf springs may be cast dummies with a $\frac{3}{16}$ in. hole drilled in the hoop to take the spiral springs made the same as those in the leading truck. The castings will probably have the spring pins and bottom lugs cast on, and will only need riveting to the frames by putting the projections on the back of the lugs through holes drilled in the frame to suit, and riveting over the ends inside the frame. Working leaf springs could be made up, if desired, as specified for *Virginia* as alternatives, using $\frac{1}{4}$ in. square brass rod for the hoops, and building up each plate from strips of $\frac{3}{16}$ in. $\times$ 30-gauge steel; but it is hardly worth trouble on an engine this size, which is intended for real work and not a glass case in the front parlour.

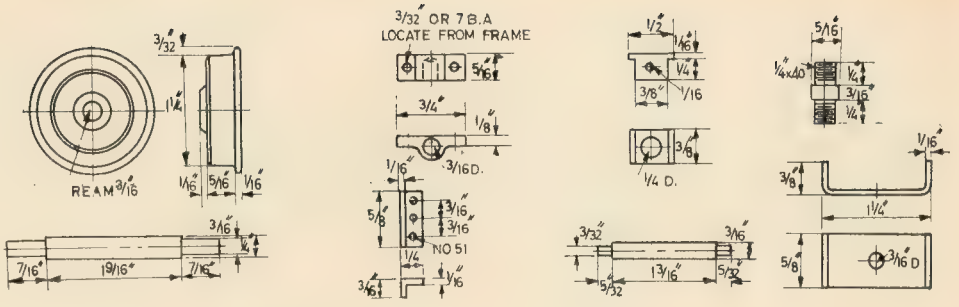
To assemble the frames, first turn the stay-rod from a bit of $\frac{3}{16}$ in. round mild steel held in the three-jaw. Turn a 3/32 in. pip a bare $\frac{1}{8}$ in. long, part off at $2\frac{3}{4}$ in. from the shoulder, reverse in the chuck and turn another similar pip. Put a frame on each end and rivet over. Then put the pivot block between the frames at the narrow end, temporarily clamp together, and drill right through the block, using the holes in the frame as a guide.

Rivet up with 3/32 in. rivets or pieces of 3/32 in. iron wire if no rivets of suitable length are available, and put a $\frac{1}{4}$ in. drill through the middle of the block, using a drilling machine or lathe, as the hole must go through dead square. The block must be flush with the top and bottom of the frames.

The axleboxes are made from bronze or gunmetal of $\frac{1}{2}$ in. $\times$ $\frac{7}{16}$ in. section, or $\frac{1}{2}$ in. square if this is not available, the process being the same as previously described, except that the hole for the axle bearing is not drilled right through. Drill from the back with $\frac{3}{16}$ in. drill to a full $\frac{5}{16}$ in. depth, and don't forget the oil hole. The boxes should be a nice sliding fit in the horncheeks, without being slack.

The axles are turned from $\frac{1}{4}$ in. round mild steel held in the chuck, and as both the wheel seat and journal bearing are the same size and turned at the one setting, they can't very well be out of truth with each other; but take care when pressing on the wheels that they are not accidentally bent.

As the axleboxes are outside, both wheels can be pressed on to the axle right away. Next put the boxes on the journals, flanges next to wheels, lay



Pony wheel and axle; leading pony details; trailing pony bolster

the frame upside down on the bench, put the springs in the holes in the hoops of the spring castings and place the wheel-and-axle assembly in position with the axleboxes between the horns. Secure them by little bolts made from $\frac{11}{16}$ in. lengths of $\frac{1}{16}$ in. silver steel with a few $\frac{1}{16}$ in. or 10 BA threads on each end, put through the holes at the bottom of the horncheeks and furnished with ordinary commercial nuts.

Don't tighten them sufficiently to grip the axlebox between the horncheeks or you will be asking for a small replica of the train wreck just south of Weedon some time ago: a tight bogie axlebox jammed in the horns, causing the bogie wheel to ride over the railhead and the train to finish its journey in a field.

ALTERNATIVE ATTACHMENTS

There are two ways of erecting the trailing truck on the frames. The first is by aid of an ordinary kingpin in a bolster attached to the frames in the usual way, but this prevents the grate and ashpan being dumped unless the nut is taken off and the truck removed first. The second is to braze the kingpin to a bracket which is attached to the bottom of the ashpan, so that when the dumping-pin is pulled out and the grate and ashpan freed, it drops down and the trailing truck drops with it.

When in place, the section of kingpin projecting above the bracket passes through a hole in the bolster and retains the truck in position, as shown in the drawing of the alternative arrangement. I have fitted this arrangement to some of my own engines, and find that it is a great convenience.

The bolster is made the same in either case. It consists merely of a strip of 16-gauge steel $\frac{5}{8}$ in. wide and 2 in. long, bent to a channel shape with an overall width of $1\frac{1}{4}$ in. Drill a $\frac{3}{16}$ in. hole in the middle. For the fixed kingpin layout, erect this at the rear end of the main frames, level with the bottom of the frames, below the cradle. Fix it with two 6 BA countersunk screws passing through No 34 holes drilled through frames and bolster flanges at each side; countersink the holes in the frames, and put nuts on the ends of the screws as shown in the section. The kingpin is turned from $\frac{1}{4}$ in. steel to the dimensions shown, and the whole bag of tricks is erected in the same way as described for the leading truck.

For the "dump-the-lot" variation, erect the bolster in a similar fashion, but with the bottom of it $\frac{1}{16}$ in. above the bottom of the frames. Cut a piece of $\frac{1}{16}$ in. sheet steel to a width of $\frac{3}{4}$ in. and a length of $1\frac{5}{8}$ in., and drill a $\frac{3}{16}$ in. hole in it at $\frac{5}{16}$ in. from one end, then put a 3/32 in. set in it as shown in the drawing. Turn the kingpin from $\frac{1}{4}$ in. round steel, but leave the upper section plain. Push this through the hole in the plate and braze or silver solder it, leaving a tiny fillet around it above and below the plate. Countersink both the hole in the bolster and the hole in the pivot block to clear these fillets when the whole lot is erected.

The tongue of the plate will be riveted to the bottom of the ashpan when you get that far with the job, and the pivot block attached to the kingpin by a nut and washer as shown. But for the time being, turn up a temporary kingpin with the middle part $\frac{1}{16}$ in. longer than illustrated, screw both ends of it and attach it to the bolster with a nut, as with the fixed one. The pony truck can then be temporarily erected with a $\frac{1}{16}$ in. washer between the bottom of the bolster and the pivot block, and the chassis will be all right for testing on the rails.

ZOE'S BIGGER SISTER

I rather fancy that the double-size version of *Zoe* will appeal to most of the good folk who have asked for information on a big narrow-gauger; but whether the cost of the castings and material will suit their pockets is a moot point! She is going to be some outsize lady and probably too heavy to lift single-handed; however, I will offer all the advice they will want.

The frames can be made to double the dimensions given for the smaller engine, with the following variations. Use $\frac{1}{8}$ in. soft mild steel, and keep the distance between them to $2\frac{7}{8}$ in., same as a standard $3\frac{1}{2}$ in. gauge job. The buffer and drag beams should be made from $1\frac{1}{2}$ in. × 1 in. × $\frac{3}{16}$ in. angle, the longer one being vertical; 1 in. × $\frac{1}{8}$ in. angle will do for fixing, with six 5/32 in. screws in each. The distance between sides of cradle should be 6 in. The hornblock openings should be $1\frac{1}{2}$ in. wide and $2\frac{1}{4}$ in. high, and the hornblocks and axleboxes the same as for the 5 in. gauge *Netta*. [Drawings of this engine, which will be useful to builders of the double-size *Zoe*, are obtainable from the Percival Marshall plans department.]

The coupled wheels should be 4 in. dia. with the same width of treads, flanges and bosses as *Netta* and other standard-gauge engines which I have described for 5 in. gauge. The coupled axles should be $\frac{3}{4}$ in. dia., the distance between the wheel seats being 3 9/32 in. They are $\frac{3}{8}$ in. dia. and 21/32 in. long.

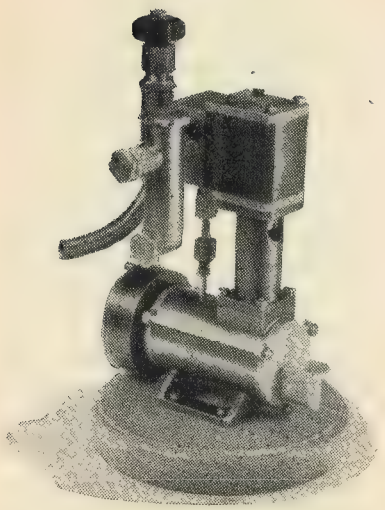
Instead of the three-section separate coupling rods specified for the $1\frac{3}{4}$ in. gauge engine, make the crankpins and coupling rods the same as for the 5 in. gauge *Netta*, but space the wheels at $4\frac{1}{2}$ in. centres (the two middle pairs being flangeless) and make the coupling rods to suit this spacing. As the cylinders will be $1\frac{1}{2}$ in. bore and $2\frac{1}{4}$ in. stroke, the crankpin holes should be drilled at $1\frac{1}{8}$ in. from the wheel centres.

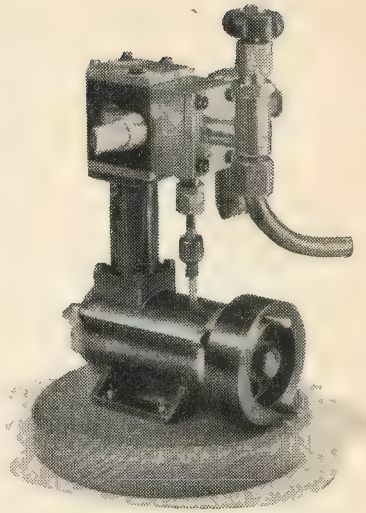
The pony trucks can be made to double size, following the same construction as described, but using $\frac{1}{8}$ in. steel plate for the frames, double-size horncheeks and axleboxes, $\frac{1}{2}$ in. axles with $\frac{7}{16}$ in. wheel seats, 3 9/32 in. between the shoulders. The pony wheels, $2\frac{1}{2}$ in. dia. on tread, are the same width as the coupled wheels. That should be sufficient to give prospective builders a start.

● *To be continued*

High speed marine steam engine

J. H. JEPSON





THE ENGINE shown is a high-speed marine unit, $\frac{5}{8}$ in. bore $\times$ $\frac{9}{16}$ in. stroke, and was made from scrap, some of which I have had for more years than I care to remember.

The cylinder block was made from a piece of mechanite, which handled almost like steel, ports, passages and dimensions being to my usual pattern for this size of engine.

A piece of shafting was used for the crankcase, which is divided into two compartments, one for the connecting rod, the other for the eccentric, with a $\frac{1}{4}$ in. ball-race in each compartment, the whole being splash lubricated.

The crosshead is circular, with the pin held by a bronze wire circlip. Not only does this keep the pin from working sideways, but it prevents its turning also.

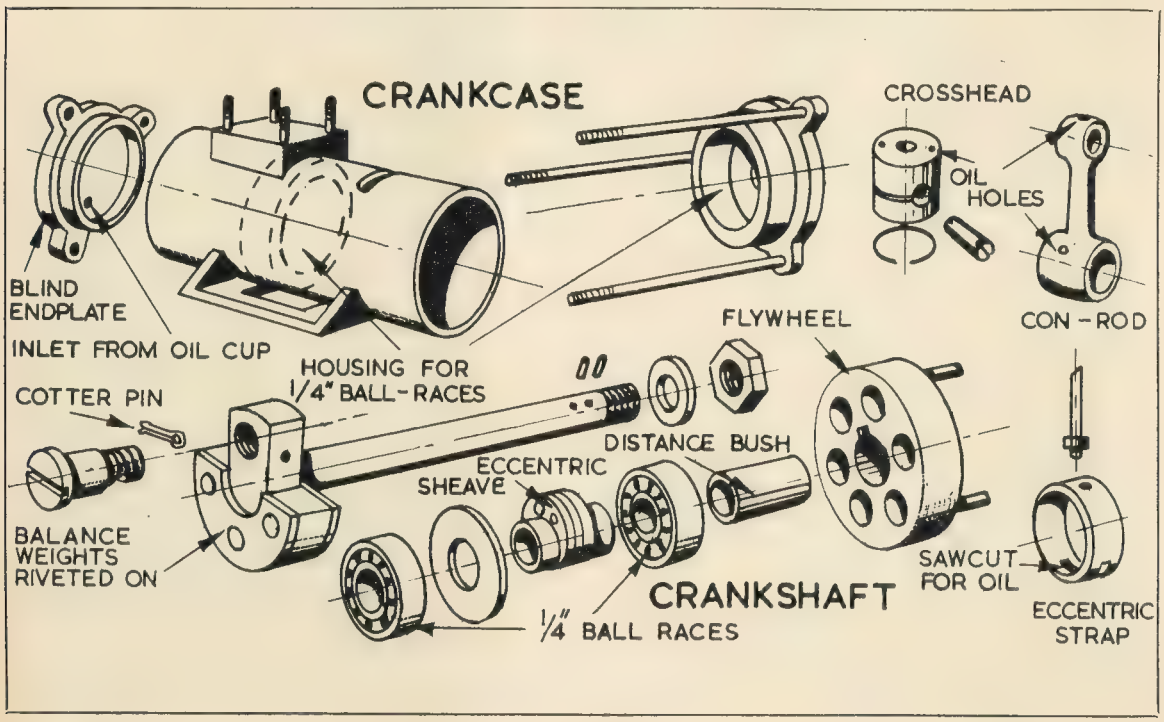
The valve rod yoke is made to form a cup for oil, so this usually neglected pin is taken good care of. Connecting rod, crankpin, eccentric sheave and strap are of mild steel, case-hardened; they should last the proverbial life-time.

Crankcase, flywheel, trunk guide and cylinder were all brightly polished with a wire brush then slowly heated to blue and dropped in oil. This finish contrasts nicely with the brass valve chest and covers, and it is also a good rust resistant.

The drain for the lubricator is in the side, in which position it is easier to operate when in a hull, and it has not the tendency to screw out when the engine is working.

The weight of the engine, all on, is $1\frac{1}{4}$ lb., and it will attain 10,000 to 12,000 r.p.m. on 120 to 150 p.s.i. ▣

Exploded drawing showing components of the engine



An uncommon type of VERTICAL BOILER

By Kyrle Willans

AT THE TIME of the attempt to rescue General Gordon, orders were placed with Willans and Robinson, at Thames Ditton, for some steam launches, and six of these were left on the firm's hands when the General was assassinated. They were all disposed of with the exception of *The Sprite*, of which an illustration gives some idea of her appearance.

This launch was kept as a work boat until the shutting down of the Ditton works when the firm moved to Rugby, and beyond the fact that she was used in the Solent by the managing director at the time of the Diamond Jubilee nothing seems to exist beyond my memories of her coming up the old Basingstoke Canal and lying off our house at Frimley Top Lock.

She was, I think, 22 ft long with a 5 ft 6 in. beam. The engine was the same size and type as that presented to the Science Museum by King George V and illustrated in Mr C. E. Page's article [ME, Nov. 1].

The engine ran condensing but, in common with a number of similar installations put out by the firm, it ran without air pump or vacuum. The exhaust from the engine went to the after end of the keel condenser and the condensate was forced into the hotwell at the expense of a certain amount of back pressure on the engine.

The boiler was fed by a pump driven from the forward end of the crankshaft, or by an inspirator. The feed pump was actuated by a crank, not an eccentric, and the crankhead bearing had its bottom half held up to the top by a spiral spring to ensure that no knock from the pump spoiled the silent running of the engine.

From a tracing of a similar installation in a 31 ft launch it would seem that the space taken up by the engine and boiler was 36 in. and the diameter of the boiler about 22 in.

Considering that the launch was built between 1882 and 1883, that the machinery was totally enclosed, and the fore and aft space taken up by a 7 b.h.p. steam-power unit, one cannot help feeling that steam launch design slipped backwards in pinning its faith to open-type engines in the face of the proof by Willans and Robinson of the practicability of enclosed-type steam machinery.

This retrograde step was particularly noticeable in the Navy. In 1878 naval steamboats were fitted with Willans engines and the success of such craft is testified to in back numbers of *Engineering* and *The Engineer*; but opposition to enclosed-type engines was resolute and later naval launches were fitted with open-type engines and enclosed-type engines only appeared just prior to the complete substitution of internal combustion engines for steam.

As a matter of fact the firm of Willans and Robinson went into yacht and launch building to combat the opposition of boatbuilders to the fitting of Willans engines.

My father's old boatman, Leonard Milbourn, who died at a great age in 1947, was a fund of information on the subject of the launches. Speaking one day to him about coal consumption led him to tell me that *Sprite*, with a party of pupils, did a test run from Thames Ditton to Windsor and back on 1 cwt of Welsh coal. The distance there and back is 42 miles so that the coal consumption per mile worked out at just under 3 lb., which, for a 22 ft launch, is not bad. One can assume that the trip started with a good fire and full boiler pressure. Welsh steam coal in those days was perfect fuel.

The steam consumption of the engine, at 28 lb. per b.h.p. was, for a 7 b.h.p. engine, well in advance of present day double-acting engine consumption, power for power, but whereas a bad engine can spoil the performance of an efficient boiler the reverse also applies, and since the performance of the machinery in the case of *Sprite* was good, it will be found of interest to consider the boiler.

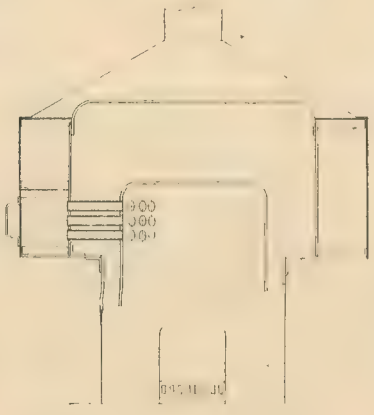
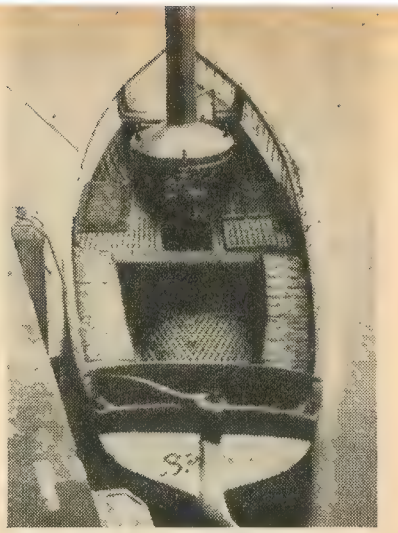


Diagram of the Willans boiler



Quayside view of the SPRITE

The boiler, while similar in appearance to the Kingdon boiler so popular in the early days of Simpson Strickland differed materially, and the sectional elevation gives some idea of its construction. The only case I have come across of the use of radial smoke tubes is the arrangement employed in the early days of the steam lorry by Robertson, of Fleetwood. In that design the radial tubes were used all round the boiler.

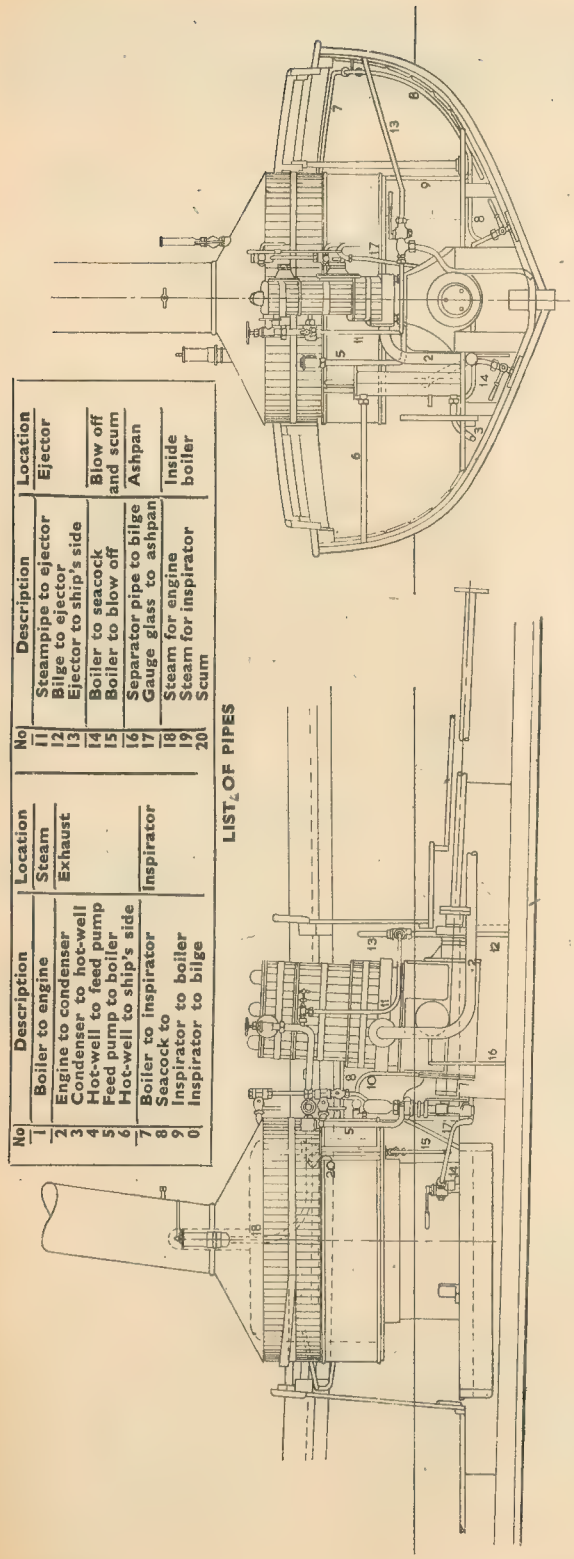
Partly tubed

In the Willans boiler, as can be seen from the diagram, the tubes were fitted only to a section and it would appear that the portion tubed was contained within about 120 deg. of the boiler circumference. In the case of *Sprite*, this 120 deg. faced forward and a curved smokebox door could be removed for tube sweeping. The tubes, incidentally, could only have been about 6 in. long and probably did not exceed 1¼ in. i.d.

The smokebox was lagged with mahogany and brass bands with, no doubt, some heat resisting material between the wood and the steel shell. This, of course, would be mainly for appearance, and it must be admitted that with a brass funnel, brass smokebox top, teak or mahogany lagging round the boiler and teak gratings surrounding the engine and after half of the boiler, the layout must have looked very good indeed.

The diagrammatic section shows that the entire upper portion of the boiler was most effectively protected from radiation by being surrounded by hot gases from the fire.

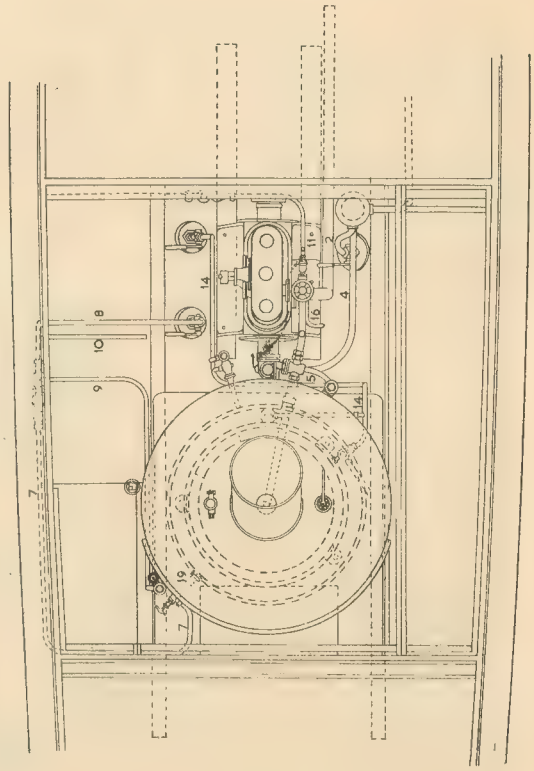
One thing I remember well about *Sprite's* boiler was that the firedoor



No	Description	Location
1	Boiler to engine	Steam
2	Engine to condenser	Exhaust
3	Condenser to hot-well	
4	Hot-well to feed pump	
5	Feed pump to boiler	
6	Hot-well to ship's side	
7	Boiler to inspirator	Inspirator
8	Seacock to inspirator	
9	Inspirator to boiler	
10	Inspirator to bilge	
11	Steampipe to ejector	Ejector
12	Bilge to ejector	
13	Ejector to ship's side	
14	Boiler to seacock	Blow off and scum
15	Boiler to blow off	
16	Separator pipe to bilge	Ashpan
17	Gauge glass to ashpan	
18	Steam for engine	Inside boiler
19	Steam for inspirator	
20	Scum	

LIST OF PIPES

STEAM ENGINE INSTALLATION FOR A 31'0" LAUNCH



was not hinged but lifted straight off the boiler for stoking, having a long handle to lift it by.

The foundation ring was broken, in way of the firedoor, and a shallow vertical grate kept the fire from falling out. On small boilers, with restricted space below the firehole ring and no mud door, it is not long before the waterway chokes up and I fancy that my father must have decided that absence of that waterway between firehole ring and foundation ring was offset by the simplification obtained.

Looking back on this 75-year-old design makes me wonder if it is not time for enthusiasts to reintroduce the steam launch, and if possible a standard hull. What interest could be caused by running competitions on fuel consumption for various kinds of engine and boiler. My grumble, as far as an i.c. engine on the river or canal is concerned, lies in the fact that there is nothing to do, and were I a younger man I should not rest until I had a steam launch built and powered as I thought best. ▣

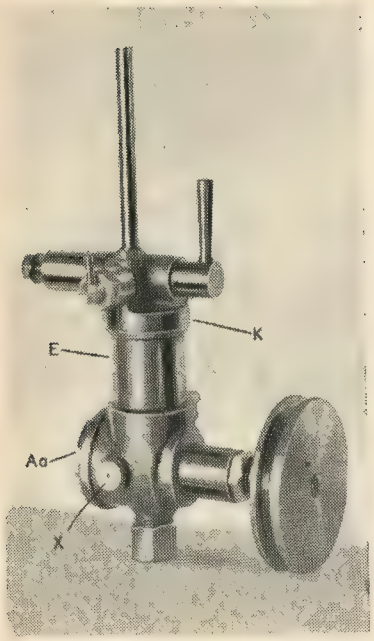


Fig. 1: *The air compressor for the spray gun*

EXPERT'S WORKSHOP

A cutting-oil feed for the lathe

By DUPLEX

THE AIR COMPRESSOR

THE small air compressor illustrated, which has a bore of 1⅛ in. and a stroke of ⅝ in., will supply an ample amount of air for operating the spray gun, if it is run at some 400 r.p.m.

Since the cylinder is screwed into the crankcase, its position can be altered at will to adjust the compression ratio and, in addition, the spring-loaded relief valve in the cylinder head enables the output pressure to be set to suit the working conditions.

THE CRANKCASE

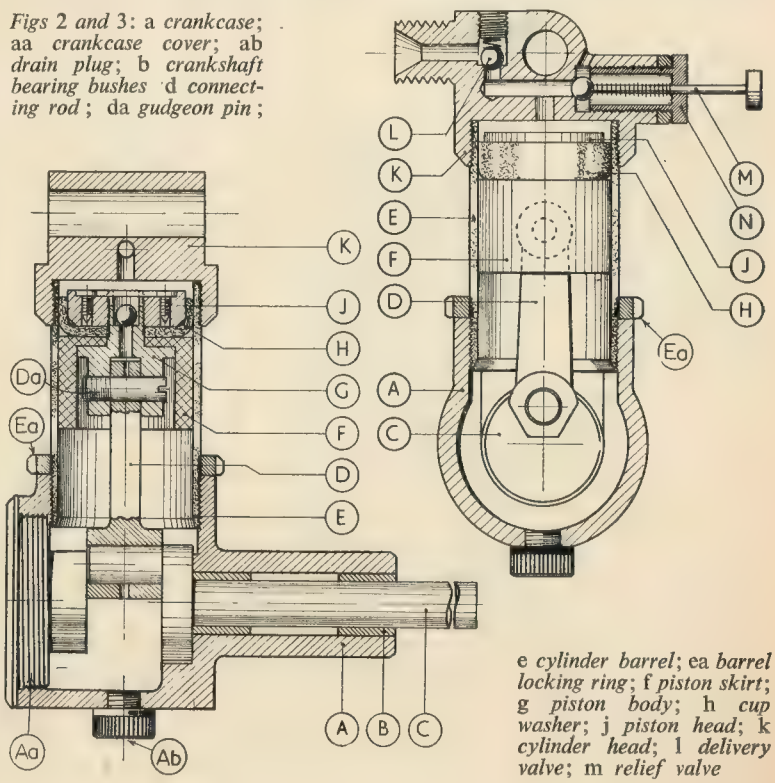
To save the time spent on making patterns and having castings made, parts such as the crankcase *A* have on several occasions in the past been machined in the workshop from a block of duralumin. As this alloy can be so quickly tooled to a high finish, even when heavy cuts are taken, it can with advantage be used in the present instance.

The prototype compressor made by Rotherhams has a cast-bronze crankcase, which is of rounded form to reduce weight, but in the present instance this is unnecessary and to save work the crankcase can quite well be made square-sided with an elongated boss turned for carrying the crankshaft bearings.

One advantage of making the crankcase in this form is that, after the material has been trued and squared up by filing or machining, the work can readily be set up on the lathe faceplate, or on an angle plate attached to the faceplate, for machining the various surfaces. On completion of the machining the external contour of the crankcase can be finished to any shape required.

If the work is to be mounted on an angle plate, it is advisable to drill and tap the hole to receive the oil filling plug *X* (Fig. 1); this hole will then serve for bolting the work to the angle plate to supplement the main strap and bolt fixing.

With the work mounted in this way and then rotated successively through an angle of 90 deg., the interior of the crankcase can be machined as well as the four faces for mounting the cylinder barrel, the crankcase cover, the drain plug, and the spigot and housing for the bearing bushes. This operation will also ensure that the



Figs 2 *and* 3: a *crankcase*; aa *crankcase cover*; ab *drain plug*; b *crankshaft bearing bushes* d *connecting rod*; da *gudgeon pin*; e *cylinder barrel*; ea *barrel locking ring*; f *piston skirt*; g *piston body*; h *cup washer*; j *piston head*; k *cylinder head*; l *delivery valve*; m *relief valve*

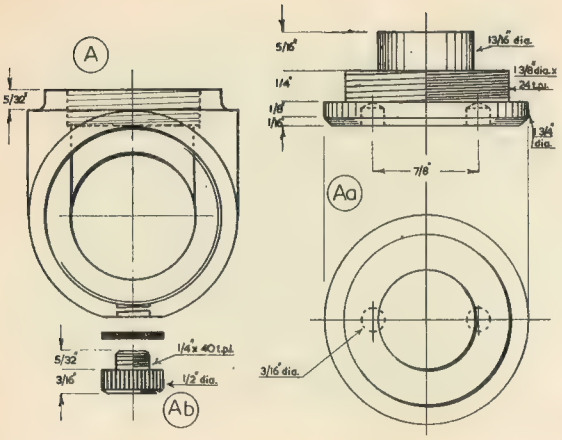


Fig. 5: a end view of the crankcase; aa crankcase cover; ab drain plug

various bores and surfaces are machined in accurate alignment.

Although some workers have found that duralumin itself forms a satisfactory bearing material for steel shafts, the bearing housing is shown fitted with phosphor-bronze or cast-iron bushes. With either plan, a central space should be left to provide an oil reservoir and give a more mechanical layout.

The two bushes are turned to an interference fit in the housing and they should be carefully drawn into place by means of a bolt and nut fitted with card washers to protect the bushes from damage. To ensure lasting service the bores of the bushes should be lapped until all tool marks have been removed and a high surface finish remains.

As the work is screwcut 24 t.p.i., the clasp-nut can be engaged at any point on the leadscrew, corresponding to any of the graduations of the thread indicator.

The end-plate fitted to the crankcase serves both to form an oil seal and to end-locate the crankshaft and the big-end of the connecting rod. At the bottom of the crankcase an oil drain plug *Ab* fits into the hole already drilled and tapped in the work; the plug *X*, which forms an oil filler as well as an air intake, is of similar dimensions.

Although in the prototype a packing gland is fitted to the outer crankshaft bearing to form an oil seal, this will not be found necessary in the modified compressor.

THE CRANKSHAFT

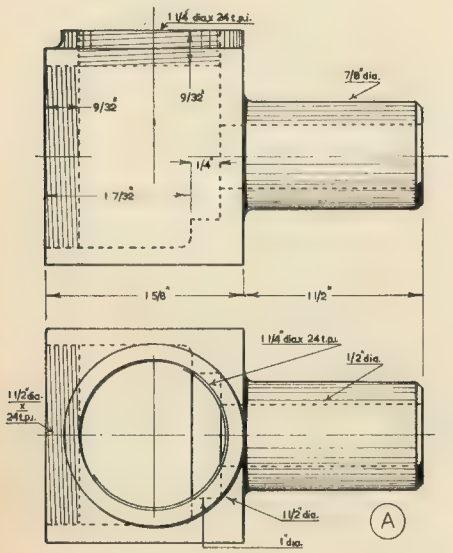
The original crankshaft *C* is machined in one piece with a $\frac{3}{8}$ in. dia. shaft, a $\frac{15}{16}$ in. dia. crank disc, and a 9/32 in. dia. integral crankpin. The crank disc and parallel shaft are first turned between centres to the finished size and the crankpin centre is marked out by placing the shaft in V-blocks resting on the surface plate for scribing a line at centre height across the crank disc with the surface gauge.

After the scriber of the surface gauge has been set $\frac{5}{16}$ in. above this centre line, with the aid of a rule mounted in a rule stand, the shaft is turned through a quarter of a circle and a cross-centre line is scribed to locate the crankpin centre. This centre mark is afterwards enlarged with a centre drill to enable it to be centred in the lathe by using a wobbler or centre-finder.

The most convenient form of centre-finder, and one that is easily made in the workshop, consists of a 6 in. rod fitted with a spring-controlled sliding, female centre to engage with the tailstock centre. At its other end the rod is machined with an accurately-centred 60 deg. point for engaging in the work centre. After the centre-finder has been mounted in this way, the test indicator is fixed to the topslide and its anvil is brought into contact with the wobbler at a point near to the coned end.

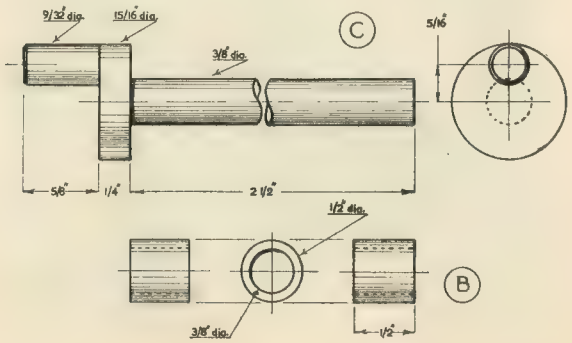
The movement of the test indicator needle is noted while the lathe mandrel is turned slowly by hand and the position of the work is adjusted until the reading of the indicator remains constant. A convenient method of mounting the crankshaft in the lathe for machining the integral crankpin with the prescribed amount of eccentricity will be described in a following article.

● *To be continued*



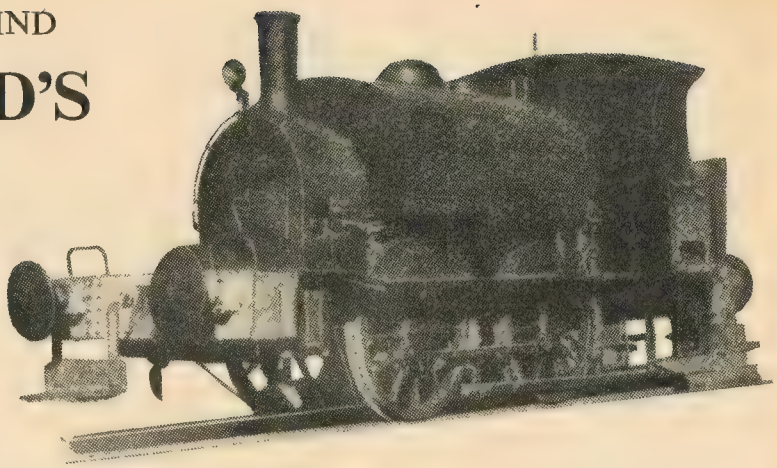
Left, Fig. 4: The crankcase

Fig. 6: c the solid crankshaft; b crankshaft bearing bushes



WHERE SHALL WE FIND

THE WORLD'S OLDEST WORKING LOCO?



asks Joseph Martin

THE oldest locomotive is like the oldest Old Etonian: there is always an older one somewhere. Obviously, no comprehensive record exists of every railway engine which has been built in the past century or more, and the oldest locomotive in the world may, therefore, for all we know, be an obscure tank on a small private line in the Congo!

If we were compelled to venture a guess on the basis of what is actually known, most of us would plump for Spain. The Spanish, with their instinctive reverence for the past and for the things which were made by other men in other times, have taken great care of their locomotives. Several 0-6-0 engines built by Kitson, Thompson and Hewitson in 1859 are still active in Spain with their original forms very little altered after nearly a hundred years.

The live-steam enthusiast travelling in Spain never knows what he may discover. At Vigo last summer, for instance, Charles R. Fox of Fox Photos came upon an 0-6-0 which appeared to be about 95.

No one will be surprised if even older engines than these are found to be still doing duty on Spanish soil. With the delivery of a huge diesel-electric locomotive, the same country also has one of the latest engines to be constructed anywhere. I wonder if this machine will work for close on a century and be eagerly photographed by some MODEL ENGINEER reader of the year 2050 ?

But if the ancient land of Spain has some very old locomotives so, too, has the comparatively new land of Australia. One of them, a Stephenson-built engine, went into retirement not long ago; her name was *Katie* and she had been working for 75 years.

It seemed indeed that *Katie*, at the time of leaving the active scene, was the oldest working railway engine in Australia. But no sooner had her claim to glory been advanced than the laurels were appropriated by *Green Hornet*, a lady of even riper years. To trace *Green Hornet's* story we must go back to the beginnings of modern Australia, to the gold-fever years when Bendigo and Ballarat were magic names.

At Minmi in New South Wales the lure was not gold but coal. Minmi became a boom town, and in 1857 the resourceful John Eales connected it by rail with Hexham on the River Hunter, seven miles away. Between these points ran an express; and the engine which drew the express was *Green Hornet*.

John Eales apparently ordered two engines from England. They were built by R. and W. Hawthorn and Company of Newcastle-on-Tyne in 1856, and their intended destination, if an old story is true, was the Crimea. Having been completed as a rush order for the Crimean War, they were then sent to Australia instead. I see nothing mysterious in this; the war ended in 1856 and locomotives constructed in that year would presumably have been too late for use in the peninsula.

The two engines ordered by John Eales—the makers numbered them 947 and 948—were of 0-4-2 type with 13 in. × 20 in. inside cylinders, 4 ft 6 in. driving wheels, 2 ft 6 in. trailing wheels and feed pumps working off crossheads. They hauled loads of 150 to 200 tons.

Above: GREEN HORNET. *She retired after working for 75 years*
[Stewart and Lloyds]

Left: *B. A. Butt, of St Ives, Cornwall, took this picture of a veteran in Barcelona. The engine was built in* 1860

In 1843, well before John Eales founded his railway, J. and A. Brown (father and uncle of John Brown, the Australian industrialist who created a great empire of mines, ships and railroads) formed a company to pioneer coal and shipping interests in the Maitland and Newcastle districts of New South Wales. Minmi is near Newcastle, and the railway had been in existence for only two years when J. and A. Brown bought it, together with Minmi colliery.

Green Hornet was No 948. By the time of the second world war she was already an octogenarian, and so the owners, Stewart and Lloyds (Australia) Pty Ltd, allowed her the dignity of an honourable retirement on a dead-end line in Newcastle. But Australia in the war years could make use of anything and everything that was capable of running on wheels. Like a Mr Chips among locomotives, *Green Hornet* emerged nobly from her retirement at the call of duty. Reconditioned and rebuilt, she proceeded to play her part as a shunter at the Newcastle works. She has now completed a century of service, and Stewart and Lloyds are, therefore, wondering if she is the oldest working locomotive in the world.

Both the Hawthorn locomotives were originally without cabs. *Green Hornet*, as the picture by Stewart and Lloyds shows her today, has the normal protection for the driver. It will also be seen that her wheel arrangement is now 0-4-0, the trailing wheels having been removed.

A century covers, of course, an enormous amount of Australian history; when *Green Hornet* arrived at Minmi, the State of New South Wales, first colonised as a convict settlement, was just beginning to enjoy the benefits of self-government and of a fully integrated community while people who had offended against the stern laws of the Old Country were still being transported to West Australia. For everyone in New South Wales *Green Hornet* has the value of a museum treasure.

I must thank Arthur P. Fox for sending a copy of *The Rocket Post*, the admirable house magazine of Robert Stephenson and Hawthorns, Ltd, a company which is itself historic. To the tribute paid by *The Rocket Post* Mr Fox adds his own.

"Steel works locomotives," he writes from Bedworth, Nuneaton, "lead a hard life, and one is amazed at the quality of craftsmanship of the old-time designers and builders of this engine. Their workmanship was indeed true and sound as they laid the foundations of our prosperity a hundred years ago.

"Maybe this little old lady from Newcastle is the first steam locomotive to achieve such a record of service. It would be interesting to know.

"Forth Banks Works may justly be proud of her. May she have a long and honourable retirement. Surely it has been richly earned!"

While most of us will never see the little old lady, distance does not lessen the warmth of our salute. "Seven cities vie for Homer dead"; and two Newcastles on opposite sides of the world can share the pride which is felt for *Green Hornet* and the skill which fashioned her a century ago.

It will no doubt interest the enthusiastic supporters of the Festiniog Railway that an engine slightly older than the Festiniog's *Prince* is to be found in the Wales down under. Charles Easton Spooner's locomotive, now aged 98, is agreed to be the oldest working locomotive in Britain. There are, as we well know, many fine veterans at work in the British Isles but it is seldom that we find one of much more than 60 on main line operations.

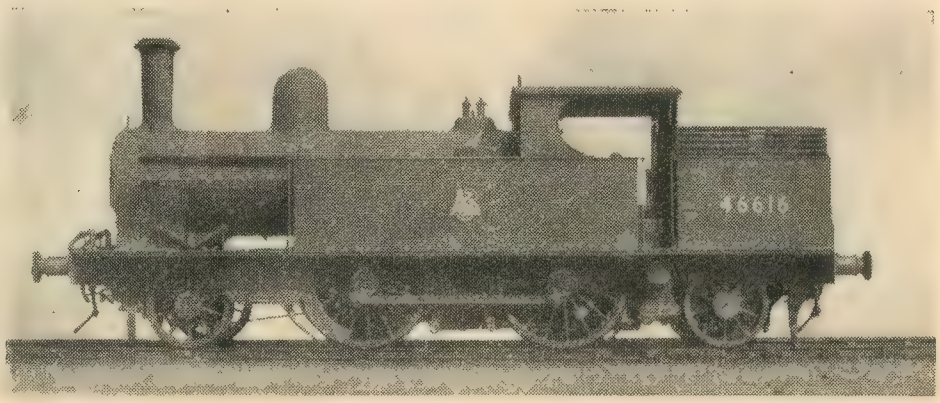
One by one the veterans are disappearing. All too often a locomotive with generations of service to her credit steams into the limelight only because her service is over and her journey ends in the dismantling yards.

This fate has now befallen locomotive No 46616, the last of the LNWR 5 ft 6 in. side-tank passenger class. After being used on West Region local work at Abergavenny, No 46616 was withdrawn in September, 1955, and has now been broken up at Crewe, where she was built in 1890. Between that year and 1897 160 2-4-2 locomotives to F. W. Webb's design were constructed for general use on branch lines, 40 of them being adapted from the 2-4-0 Precursor class (not to be confused with George White's 4-4-0 Precursors of later fame). Many were fitted with vacuum-control gear for working push-and-pull trains.

The LNWR added the first engine to stock in October 1890, a month after its completion. Two years later, in August, the first of the Precursors, No 1144 *Druid* was rebuilt as a 5 ft 6 in. side-tank passenger, the LNWR receiving her in December. No 2147 *Champion*, completed in November 1895, was the last of the rebuilds.

Apart, therefore, from having put in 65 years of service, No 46616 is a direct link with the richest, busiest, smartest and most punctual of British railways in the lively Nineties, and in particular with Francis W. Webb, the dictator whose special mania was the compound principle.

Of this lonely, stiffly courteous autocrat, one of the strangest figures in railway engineering, O. S. Nock has a good deal to tell us in his new book *Steam Locomotive* (Allen and Unwin, 25s.); a delightful book that pays deserved homage to the locomotives and men who together created the great Age of Steam. ▣



F. W. Webb's 2-4-2 T No 46616, withdrawn from service at September 10 weekend, 1955, and now broken up
[British Railways picture]

POSTBAG

The Editor welcomes letters for these columns, but they must be brief. Photographs are invited which illustrate points of interest raised by the writer

ELECTRIC CLOCKS

SIR,—I have been very interested in the recent correspondence on electric clocks.

I am puzzled by the slavish adherance to the designer's drawings, as this part of the clock has nothing critical about it except that it shall be rigid and symmetrical.

When I made my first electric clock I, too, was stumped for a piece of thin spring steel, until a friend pointed out that I threw away several good pieces a week. Yes, razor blades!

This material is highly suitable; it is perfectly heat treated, is regular in shape, it already has holes in it and, furthermore, if you happen to break it an absolutely identical piece is available. My first clock had a ¾ sec. 8 lb. pendulum swinging on a razor blade and was driven by Sir David Gill's adaptation of Froment, as suggested by W. H. B. Clark.

It kept good time but the constant racket nearly drove us mad, so it was converted to Hipp escapement with, believe it or not, an increase in accuracy. The Gill movement, operating as it does at every swing, interferes too much with the pendulum and subjects it to too much control.

My second clock was a much more ambitious project and was my version of the well-known Synchronome. It was made entirely from rusty scrap iron filed and stoned to a bright finish, and it was fitted with third grade Invar rod supporting a 16 lb. bob with Invar steel compensation. This again swung on a razor blade, and has done so for seven years. The accuracy is as good as can be expected for a pendulum swinging in air.

It maintained its rate plus or minus 3 sec. for about six months when first tested, the error slowly changing day by day over about a month from plus to minus. The clock is now part of the family and is never checked until someone notices it is half a minute fast or slow, when it is jogged up one tooth. This happens once or twice a year only.

The count wheel, which is the main source of friction, runs in graphite bearings with the result that the gravity arm is very much lighter than a commercial one.

If Mr Clark wants accuracy, why not go the whole hog and make a Shortt-Synchronome; that, is master and slave. This would make a fine addition to anyone's hall. He will, however, never achieve real accuracy unless the clock is kept at constant temperature in a low, constant-pressure atmosphere, and insulated from vibration.

Anyone who has already made a Synchronome could add the Shortt part, as it only needs a synchroniser added to the slave and the pendulum lengthened to give it a losing rate.

Those wanting information on electric clocks can do no better than read Hope-Jones book *Electric Time Keeping*.

Fleet, Hants. J. A. BAMFORD.

CANAL SIGNALS

SIR,—With reference to the picture and paragraph relating to the use of railway signals in connection with British Transport Waterways' Saltersford Locks [Smoke Rings, May 16], this is not unique as signals of Great Central Railway design have been utilised for controlling the movement of ships in the Town Docks at Grimsby for many years, and there may possibly be other instances up and down the country.

What *is* unusual, however, is that although the Saltersford signals are constructed from British Railways standard signal parts, the one on the left, shown in the clear position, is actually built wrong way round, i.e., it points to the right when viewed from the operational side.

This raises a further point: as both arms are white with a black stripe, it would appear that they both control traffic entering the locks and thus it would seem that both locks are two-way.

Leeds. G. H. BUTLAND.

CHUCK PACKINGS

SIR,—The contribution by S. J. Applewhite under Readers' Hints [April 11], on the keeping of chuck packings in place, interested me. The method I've used successfully for some time, is to obtain a small tube of Pliobond, manufactured by Goodyear Tyre Co., see that the chuck jaws, or any other place where the packing is to be placed, are clean and have no small pieces of grit kicking about, give a touch of the solution on packing and chuck jaw, press the two into contact and leave for a few minutes. After that they won't fly off or drop on the lathe tray or floor.

Don't overdo the quantity of Pliobond; a mere touch is all that is necessary. Removal is easy; just the application of a small knife or even the finger nail is all that is necessary. The plastic has a rubber base.

Johannesburg GEO. E. PERREM.

STEAM CAR IN STEAM

SIR,—I was lucky enough to take these two photographs of an 1897 steam car when it passed my house. The car is illustrated in R. H. Clark's book *Steam Engine Builders of Norfolk*.

Soames steam car of 1897, *travelling at about* 15 *m.p.h. while on a Veteran Car Rally in Norfolk this year*

It travelled quite silently, except for the rumble of its iron-shod wheels, and appeared to be in perfect order throughout. Doubtless it has had a considerable amount of restoration work done to it.
King's Lynn. A. BEAUMONT.

A CHARABANC

SIR,—Reader Atkinson's query can be answered neatly as an early example of British export, to wit, one Albion charabanc.

One of these vehicles used to operate between the village of my boyhood and the then seemingly fabulous town of Dartford, in Kent. To me the six-mile journey took on all the excitement of an expedition into a far country. We boys fought for the back seats from where a strange new angle of the countryside was to be seen.

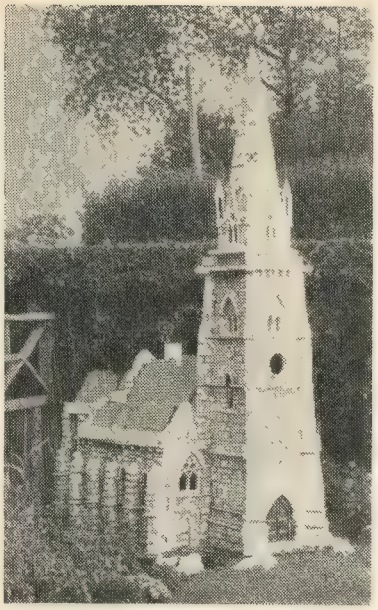
I recollect the indifferent running of the massive engine, the ponderous gate-chage gearshift, which needed a great deal of effort before a change was effected, the fierce take up of the metal-to-metal clutch, the bumpy road which behove those who occupied the outside seats to take firm grip on the seat rail, the whirring of the chain drive, the driver who always wore a cap back to front, a Norfolk jacket, stiff white collar and bow, cavalry trousers and the inevitable brown highly polished leggings and boots. He seemed to spend a lot of time watching the drip feed oil system affixed to the dashboard.

In high summer a dusty time was had by all, but let it be whispered that the fare was a nimble sixpence and the time was 20 minutes, which rather makes today's performances food for thought. In those days, however, my mind was mostly concerned with the one word "Jobmasters," after the owner's name on the chassis. I never have found out the true definition of that word.

Still it's a happy picture to contemplate, and were it not for the strange wording on the shop behind, it might well be Lowfield Street, Dartford, a stone's throw from the parish church where, I was told recently, there is a stained glass window to Richard Trevithick's memory.
Sedlescombe, Sussex. GEORGE W. EVES.

SIR,—In reply to Postbag item, "What is it" [ME, May 16], this vehicle is probably a Commer car. It has solid tyres, chain drive, as shown, and a four-cylinder petrol engine. One driver only was required. I think it had a gate-change gearbox.

Prior to 1914, a stepped seat bus of this type ran between Sandringham and Black Rock, Melbourne, at the time when the horse tram was on the way out in that area.
Victoria, Australia. R. P. WHALLEY.



A model church at Halewood. See Mr Howarth's letter

MODEL CHURCH

SIR,—Seeing the model village in the ME for April 11 reminded me of a photograph I took of a model church at Halewood, near Liverpool.

I would like to see a picture of a carter steam wagon; it was the centenary at Rochdale last year and it reminded me that they were made there.

Mr Corbishley, of Macclesfield, will find three traction engines at High Legh, near Knutsford, one at Holmes Chapel, and one near Widnes.
Widnes, Lancs. G. HOWARTH.

OUR COVER

SIR,—We see that the young gent on your cover [ME, May 16] is operating, to use your own words, "A modern lathe equipped with an electronically controlled head."

If this is the case may we please have a picture of a young gent operating *a universal grinding machine*.

We up North wish you all good luck with the ME in its present form but please Mr Editor let us have the technical details correct !
Middleton, Lancs. NORMAN and BOB.

SIR,—A good brickbat to you for describing the machine on this week's cover as a lathe. The poor operator has a third-rate tutor if he lets him leave the micrometers to catch the grinding dust !
Shipley, Yorks. FRANK D. WOODALL.

It reminds us of the old joke about Henry Ford, senior, who, when asked in the early days of motoring why his cars were never painted in colours, replied: "But people can have any colours they like—provided it's black."

Well, you can have a cover picture of any lathe you like—provided it's a grinding machine !

Fear not; we shall survive it all. —Editor.

PASSENGER CARRYING

SIR,—A query regarding the size of a passenger carrying track [March 21] is answered to the effect that "3½ in. gauge is usually regarded as the smallest on which passengers can be carried with any comfort and safety."

A hasty perusal of past issues of MODEL ENGINEER, and particularly the earlier LBSC articles, showed numerous instances of passenger carrying on 2½ in. gauge, and the article on page 327, 4 October, 1934, on "Suburban Garden Railways" discusses this subject well.

I assume that the reply is concerned with the stability of the car, rather than the ability of the locomotive to haul a human being.

On many occasions I have been privileged to drive George R. Thomas' very fine Baltimore and Ohio class 4-6-2 President on 2½ in. gauge, and found no difficulty in mantaining my balance on the rider car. This was on the track of the Pennsylvania Live Steamers, laid on the ground, and the engine easily and regularly made the 685 ft loop in 45 sec.
Wayne, Penn. FRANK H. MOORE.

BLOWER MOTORS

SIR,—Despite LBSC's warning readers need have no fears about putting a casing round a steam-raising fan. It will not "greatly reduce the efficiency." I am not an expert on aerodynamics but I think it is quite possible that a *correctly designed* casing would raise the efficiency.

Unless there is something seriously amiss with the boiler only a very gentle draught is needed to raise enough steam to work the blower.

As I pointed out before, the great advantage of the hand blower is that the draught can be regulated to suit the locomotive.

In reply to Mr Summersgill, there are a number of types of blower on the market and prices range from about 7s. 6d. to 35s. The last adverts

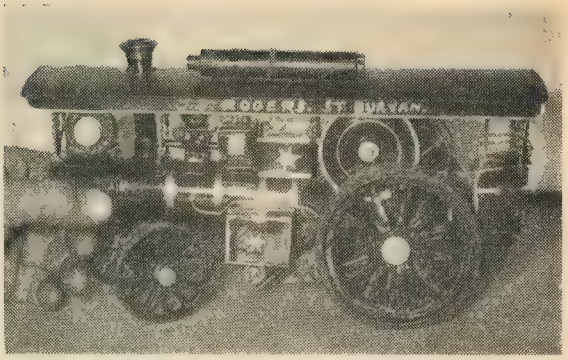
POSTBAG . . .

of the Hoover blower I can trace were last November: H. Franks, of 58-60 New Oxford Street, W.C.1 (32s. 6d.); Radio and Electrical Mart, 309 Harrow Road, Wembley (30s).

Some time ago I obtained two blowers locally for 10s. and 15s., but articles on the construction of car heaters have raised their price.

Since your correspondent is in Yorkshire he might try K. McGrath, of Middlesbrough, though I cannot at present find the full address.

Birmingham 26 J. H. BALLENY.

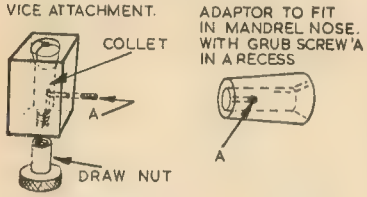


A model of a scenic Burrell traction engine built by John J. Rogers, of Penzance

COLLET ADAPTORS

SIR,—I would like to call attention to the many useful applications of collet chucks in model engineering. It is not difficult to make adaptors for 8 mm. collets to fit in the mandrel, tailstock, milling spindle, drilling spindle, cross-slide dividing attachment, etc., and last but not least, to hold things in the vice.

There is one matter, however, which is difficult; this is the tiny grubscrew



The collet, draw nut and adaptor described by I. C. Davis

A which prevents the collet turning. In the vice appliance, this matter is simple, but in the other appliances, which are all mandrels, it is important that the screw *A* does not interfere with the accurate centring of the collet.

Usually an adaptor fits into the nose of the mandrel and the collet slides into this, positioned by *A*. First, *A* must not protrude too far into the bore, secondly, the head of *A* must be recessed into the adaptor so as to maintain the adaptor's accuracy.

This is done by boring and screwing the hole for *A*; making *A* of silver steel; trying it in position with a collet inserted to see it protrudes the exact amount, not touching the collet; cutting off about $\frac{1}{16}$ in. full; and inserting in the vice attachment and putting in a saw cut $\frac{1}{8}$ in. deep in the right place. The right place is so that the saw cut is longitudinal.

Remove the top $\frac{1}{16}$ in. plus by filing (in the vice attachment) and replace in the adaptor so that the saw scerf is longitudinal again. With a centre punch, move the metal of the adaptor so that the screw *A* cannot move in or out by burring the metal into the saw kerf.

Another way: the joining shackle of the anchor cable has the pin flush; naturally t must not protrude. In turn, this pin is held in by a small tapered cross-pin through one of the lugs of the shackle. This small taper pin is kept in place by a lead pellet hammered into a recess above the position the tapered pin assumes. It cannot come out and yet it can be knocked out by a drift from the small side.

This idea can be used in the collet adaptor: a dentist's drill can undercut the recess for the small shot pellet.

Crowborough. J. C. DAVIS

TRACTION ENGINES

SIR,—With reference to C. E. Page's excellent addition to "Traction Engine Topics" [MODEL ENGINEER, April 25], I must question his statement that Burrell's, following the success of their single-crank compound design, decided to build no further double-crank compound engines.

A Burrell catalogue of 1923, in my possession, lists *both* single-crank and double-crank compound engines, and several road locomotives were built on the double-crank compound system in the early Twenties, and are still in use in private ownership.

The Foden compound, although an excellent engine, particularly on soft ground, was never one of the most handsome engines, with its very short smokebox and large diameter rear wheels containing a great number of spokes.

Tredunnock, JOHN HAINING.
Monmouthshire.

Miss Ten-to-eight . . .

It was always assumed that the seize-up was due to some temperature effect, but after the last overhaul, when the pistons were removed for inspection and repacked as a matter of course, the same symptons returned *after* the first steam up. It was concluded that the soft packing was the cause, but exactly why, still remains a mystery. It may be added that at the time of this overhaul no measurable wear could be detected on the pistons or cylinder bores.

The Tyneside track was opened in 1951 and it was at last possible to get down to some real driving. This at first was not as easy as had been imagined but not many weekends passed before—hauling about quarter of a ton at high speed—the only stops were voluntary ones for water, coal or oil. Various fuels have been tried and it is agreed among the club drivers that Phurnod Peas are ideal. Unfortunately this form is not available locally so ordinary Phurnacite has to be used, broken to a suitable size for the different scales.

The engine has run for six seasons and it is estimated to have run nearly 1,000 actual miles in this period. The only replacements due to wear have been coupling rod bushes, rear axle and axleboxes and the Joy gear dieblocks. The big ends have been taken up, but no wear was discernible on the links and pins of the valve gear as these were all case-hardened originally.

Side control springs are fitted to the bogie, and running is very stable and derailments are unknown. The engine will run fast and, to date, the best lap time has been 36 sec. for the 700 ft. This is an actual speed of 13.3 m.p.h. or a scale speed of 213 m.p.h. The load was 350 lb., or equivalent to about 300 tons full size. ▣

AROUND THE TRADE

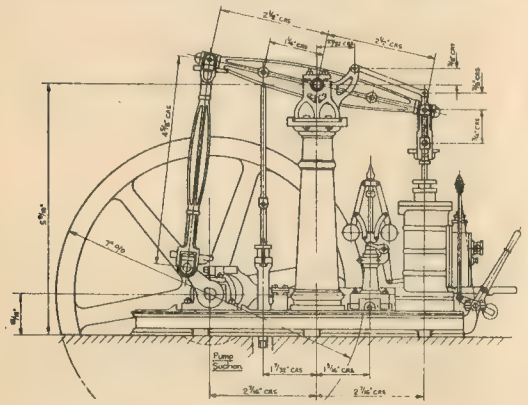
A regular feature describing tools and accessories of use in the workshop

Conducted by EDGAR T. WESTBURY

Period steam engine models

A VERY interesting series of designs for historic types of steam engines has been introduced by Precision Models Co., of Butts Road, Woking, Surrey. These have been prepared by Mr G. K. King, AMIMechE, and are drawn in full detail to a scale of 1 in. to 1 ft. Great care has been taken to preserve accuracy in proportions and essential features, consistent with facility for construction in reduced size, and the castings supplied are also of high quality and precision.

The designs include the return-crank horizontal Fieldhouse engine (c. 1850), a centre-column beam engine (c. 1840), a vertical " crank-overhead "



Left: An example to a reduced scale, of the type of draw— offered by Period Models. This is of an 1840 *beam engine*

Below: The new general duty, two-speed drill made by Wolf

10 h.p. engine, a 2 h.p. trunnion-type oscillating engine by Hick, of Bolton, and two examples of Trevithick high-pressure engines. We have examined specimens of both drawings and castings, and have no doubt that they will be welcomed by readers interested in the construction of early steam engines.

Details and prices can be obtained from the above address on receipt of a 2½d. stamp.

High-duty lubricants

THE properties of molybdenum disulphide as a lubricant to withstand extreme bearing pressure have already been referred to in these columns, and are now being exploited in various ways, not only for working parts of machinery but also in cutting lubricants for machine tools.

Among the products in this category, the compounds manufactured by Rocol Ltd, Ibex House, Minories, London EC3, are of special interest. They include " RTD " compound, an all-purpose lubricant for reaming, drilling and tapping, also as an additive to standard cutting oils and emulsions. It prolongs tool life and enables finish to be improved, particularly when machining hard or tough materials which present difficulties in the ordinary way.

Rocol anti-scuffing paste provides a means of applying high-duty lubricant to surfaces which are normally difficult to keep properly lubricated, such as lathe centres, thrust pads, and tool slides; also for preventing seizure and reducing the required force in press-fitting axles and shafts.

We have obtained very good results with both these compounds, which have been tried out in the workshop over a long period. They are supplied in collapsible tubes of small size, but adequate in view of the effectiveness of the lubricant in minute quantities.

New Wolf two-speed portable drill

A GENERAL duty, ½ in. capacity, two-speed portable electric drill has now been made available by Wolf Electric Tools. This machine permits ¼ in. (high speed) and ½ in. (low speed) drilling operations in metal at the correct cutting speeds and with the minimum of effort.

An advantage with this machine is that ½ in. holes in hard materials, can be drilled at extremely high penetration speeds by first driving a ¼ in. pilot hole before boring to size.

For hardwood, the drilling capacities are higher, namely 1 in. on the low speed, and ⅝ in. on the high speed. A further feature of this new machine is that the switch handle is fitted with a specially moulded insulation.

The gearbox assembly incorporates a selector mechanism and the transmission is through constant-mesh gears, speed selection being obtained by the engagement of clutches integral with the final spindle gear wheels.

CATALOGUES RECEIVED

The Garner Buyer's Guide, 1957

This hardy annual has turned up again, full of information on the latest in machine equipment and small tools for both amateur and professional engineers. It also contains details of the Garner Personal Hire Purchase plan which is applicable to all items listed in the Guide. All inquiries should be addressed to T. Garner and Son Ltd, 6-8 Primrose Hill, Barnsley, Yorks.

READERS' QUERIES

Do not forget the query coupon on the last page of this issue

This free advice service is open to all readers. Queries must be on subjects within the scope of this journal. The replies published are extracts from fuller replies sent through the post: queries must not be sent with any other communications: valuations of models, or advice on selling, cannot be given: stamped addressed envelope and query coupon with each query. Mark envelope "Query," Model Engineer, 19-20 Noel Street, London, W.1.

Carburettor for Kittiwake

I have completed a 15 c.c. *Kittiwake* engine for my 3 ft 6 in. hydroplane, and I would be grateful for your advice on a carburettor that would be suitable for this motor.

I cannot get enough height for gravity feed—and I do not want to use a pressurised tank. Therefore, I would like to exclude the use of a float chamber.—D.W.H., Guildford, Surrey.

▲ *The type of carburettor recommended for the* 15 *c.c.* KITTIWAKE *engine is the Atom Type R, drawings for which are obtainable from the Percival Marshall postal sales department, price* 2*s.* 9*d.* (*Ref. No P.E.*8).

As to your second point, any type of carburettor can be used without a float chamber subject to certain limitations, as it is quite impossible to obtain a perfectly constant jet output with a varying level of fuel in the tank unless some type of feed-regulating device equivalent to a float chamber is employed.

This matter has been explained in several articles in MODEL ENGINEER, *including a comparatively recent one describing the construction of the carburettor for the* DOLPHIN *engine in the issue dated* 2 *June* 1955. *You are strongly advised to read this article in order that you may be able to assess the desirability or otherwise of using a float chamber in your particular case.*

Circular saw

I propose building a circular-saw spindle for wood cutting, but require the following information.

a What is the greatest diameter saw a $\frac{1}{4}$ h.p. motor is able to drive?

b At what speed should the saw revolve not on load?

c What maximum thickness of wood can be cut on such a saw?—T.L.P., Liverpool.

▲ a *Only a limited efficiency can be expected from* $\frac{1}{4}$ *h.p. in driving a circular saw for wood work, as this absorbs a considerable amount of power, and even with a saw as small as* 6 *in. dia. it cannot be driven at anything like its full efficiency. It is, however, possible to do quite useful work with a* 6 *in. saw driven by a* $\frac{1}{4}$ *h.p. motor if the feed is regulated to suit.*

b *The recommended speed for general purposes in industrial circular saws is approximately* 10,000 *ft per min. at the periphery of the saw, which would be approximately equivalent to* 3,000 *r.p.m. with an* 18 *in. dia. saw. Obviously, it will not be possible to run at comparable surface speed, but from* 2,500 *to* 3,000 *r.p.m. would be suitable for a* 6 *in. saw.*

c *It is possible to cut wood up to* 2 *in. thickness with a* 6 *in. saw, but obviously the rate of feed would have to be much slower than with thinner wood.*

Adapting a compressor

I have recently acquired a twin-cylinder air compressor and wish to adapt it for workshop use. It is $1\frac{1}{2}$ in. bore × $1\frac{1}{2}$ in. stroke operating at 180 p.s.i. At what speed should the machine be driven and what h.p. motor is required?

One further point: I cannot detect any air intakes. Where are these likely to be?—W.H.P., Stoke-on-Trent.

▲ *This compressor will presumably be obtained from refrigerating plant and would be capable of being driven by a* $\frac{1}{4}$ *h.p. motor and for working at a speed of about* 700 *r.p.m.—that is to say, about half the speed of the standard form of fractional horsepower motor generally used for driving such compressors.*

Most of these compressors take their air in through the crank case, and there will probably be an inlet connection on the crank case and probably inlet valves or transfer ports in the pistons. The delivery valves on both the cylinders will discharge into the cylinder head and there will only be one delivery port.

Small-lathe drive

Could you tell me if it is necessary to drive a lathe through a countershaft if an electric motor is being used? The type of lathe I intend to use is fairly small, being 3 in. × 11 in. screwcutting.

Could you also recommend any books dealing with the selection and use of small metal-turning lathes?—D.J., Newcastle upon Tyne.

▲ *It is, of course, possible to drive the lathe without an intermediate countershaft simply by using a cone pulley on the motor shaft, similar to that on the lathe itself but with the pulleys arranged in reverse order. This will produce a middle speed of the lathe mandrel equal to that of the motor, leaving belt slip out of account, and correspondingly higher and lower speeds on the other steps of the pulley.*

Unfortunately, however, this range of speeds will generally be found too high for driving a model-making lathe, and the main use of the countershaft is to reduce the speed to a much more suitable range. In practice, it is generally found desirable to run the countershaft at one-third to one-quarter of the motor speed, assuming that a motor of 1,400 *to* 1,500 *r.p.m. is employed. This will give a countershaft speed of* 350 *to* 450 *r.p.m., which is suitable for most lathes in this class.*

For books on the choice and operation of small metal-turning lathes, the following are recommended:

Beginner's Guide to the Lathe, price 3*s.* 6*d.*

Practical Lessons in Metal Turning and Screwcutting, price 6*s.*

The M.E. Lathe Manual, price 12*s.* 6*d.*

The latter book gives full information on model making lathes and their driving mechanism.

Connecting wires

I have recently acquired a small electric Magslip motor. It has been very roughly handled and all connections have been severed, leaving trailing ends of wire poking through the brush end. There are three of these wires coming through holes marked 1, 2 and 3 respectively. The two brush connections are marked *X* and *Y* and there appears to be six other connections (some broken off) whose function is not quite clear. I should, therefore, welcome any advice you may be able to offer on connecting these wires.—G.A.F., Portsmouth.

▲ *There is a very large number of types of Magslip motors and transmitters available on the surplus market and it is possible to convert some of them to operate as a.c. induction motors by using 3-phase current, or, alternatively, introducing some method of phase shifting by means of resistances and condensers.*

The wires mentioned presumably form connections to the phase windings and in the event of operating on 3-phase current would be connected to the three live leads of the a.c. supply, in which case the motor would run at synchronous speed with the frequency of the supply.

CLUB NEWS

EDITED BY THE CLUBMAN

"WE cannot praise too highly the local council," writes F. G. Mears of Southend MPBC, another club which—like those mentioned here last week—exists in an area where its value to the community is officially acknowledged.

Southend-on-Sea (the town likes to have the sea near it in print) has, as many readers know, a council marvellously alert to every local amenity. When the club's lake needed weeding, the corporation undertook the work—and also built a concrete platform where members and visitors could launch their craft.

This platform measures 18 ft square and is especially useful for the hydroplane specialists.

Needless to say, the club has a Southend welcome for visitors. They may come to the club house by the lake or to the meetings held on the first Friday in the month at the Queen's Road Ambulance Hall in Southend itself.

The regattas

Local regattas are running throughout the summer. They opened in April and the next is on July 21, with others following on August 5, August 18, September 8 and September 29. All begin at 2.30 p.m., but the **MPBA** regatta on July 28 will be in merry swing from 11.30 a.m. onwards.

Secretary B. S. Smith (133 Leigh Hall Road, Leigh-on-Sea, Essex) tells me the MPBC numbers, among its new members, several very junior ones "who are necessary to the progress of model boat clubs." These juniors are taught and helped by the veterans, some of whom are founder members.

For service at the beginning of the present season the club built a very useful punt dinghy 7 ft 9 in. long × 4 ft beam.

ELEVEN DEVOTED MEN

Southend-on-Sea is 36 miles from London. How are the other clubs in the London area faring?

The answer seems to be "Very well, thank you." Here, for instance, is the **Bethnal Green SMEE.** Bethnal Green is a small club with only 11 members, yet these devoted 11 have under construction a 3½ in. gauge *Britannia*, a 3½ in. gauge *Netta*, a 3½ in. gauge *Tich* in a large-boilered version, a 3½ in. gauge *Virginia*, a 2½ in. gauge *Olympiade* and a 2½ in. gauge *Southern Maid*.

I doubt if some much larger clubs could beat this programme—and how many can match it in proportion to the membership? Note, too, that one of the engines is a *Virginia*.

All this represents the work of under a dozen men who have also been busy at the club in various other ways. When secretary C. Goldstream (26 Hillside Avenue, Woodford Green, Essex) wrote to me, the club locomotive *Minx* was being overhauled and the multi-gauge portable track was being extended in readiness for the coming season.

"As you will no doubt have noticed," writes Mr Goldstream in one of the best letters that I have received so far this year, "our main interest lies in locomotive construction; but we have one marine member who is at present constructing a steam-powered tug.

"The building and development of the OO gauge layout is at the moment completely static; of the two members one is unable to attend, except for a few odd occasions, and the other has been pressed into service on the passenger-carrying track extension."

As soon as possible I shall be saying something about the progress of clubs at Acton, Harrow and Reading.

M.E. DIARY

June 13.—Sheffield and District S.M.E.E. at Sheffield Joint Model Societies' Exhibition, St Mary's Community Centre, Bramall Lane, Sheffield (June 13-15).

June 15.—West Midlands Federation Rally, Wolverhampton track, Wombourne (June 15, 2 p.m.; June 16, 11 a.m.). Railway Enthusiasts' Club London area rail tour. Birmingham S.M.E. track at Princess Alice Orphanage, Erdington. Ashdon, Saffron Walden and District Y.F.C. Steam Festival, Hadstock Aerodrome.

June 16.—Worcester and District M.E.S. track running at Waverley Street, Diglis, 11 a.m. I.R.C.M.S., Kingsley Hotel, London, 2 p.m., Railway Enthusiasts' Club visit to Severn pumping engines at Sudbrook. Wallasey and Crosby clubs joint regatta, Central Park, Wallasey. Coventry M.P.B.A. regatta.

PHOTOGRAPHIC COMPETITION

CONDITIONS OF ENTRY

1. The photographs submitted shall be of any form of model engineering and must be taken by the competitor but may be developed commercially. Prints should be unmounted, not more than 10 in. x 8 in. and not less than half-plate (4½ in. x 6½ in.).
2. Competitors may send more than one photograph but each must have a coupon from Model Engineer firmly pasted on the back. Coupons will be published each week until the closing date.
3. The closing date will be July 31. Entries to be sent to: Photographic Competition, Model Engineer, 19-20 Noel Street, London, W.1.
4. A first prize of £10 will be provided, with second prize of £5 and third of £3. In addition, 10s. 6d. will be paid for each other photograph published in Model Engineer.
5. Prints will not be returned and the Editor reserves the right to publish any of them in Model Engineer.
6. Copyright of photographs sent must rest with the competitor.
7. The decision of the Editor shall be final in any question affecting the competition.

ENTRY FORM

(To be pasted on the back of each entry)

Name.....
(Block letters)

Address.....

.....

If member of a club, give its name.....

.....

I agree to the conditions and certify that I took the picture submitted.

Signed.....

DETAILS OF PHOTOGRAPH

Title .....

Builder of model(s) in picture:

Name .....

Address .....

.....

Further details of model(s).....

.....

.....

Camera..... Exposure.....

Film or plate..... Lighting.....

Stop.....

Any other information.....

.....

Model Engineer

Classified Advertisements together with remittance should be sent to Model Engineer, 19/20, Noel Street, London, W.1, by latest Thursday morning prior to date of publication. Advertisements will be accepted from recognised sources by telephone. GERRARD 8811. Ex. 4

CLASSIFIED ADVERTISEMENTS

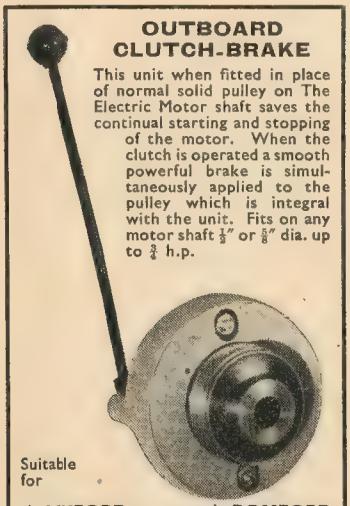
★ Private: 3d. per word. Trade: 6d. per word. Minimum 12 words. Use of box 1s. 0d. extra.
★ Rates for displayed advertising in this section. Trade 35s., Staff 45s., per single column inch. (Column width 1⅞ in.)

The Advertisement Manager reserves the right to refuse or suspend advertisements without giving any reason. Every care is taken to avoid mistakes, but the publishers cannot be held liable in any way for printing errors or omissions. Receipt of "copy" for publication implies acceptance of these conditions by the advertiser. Whilst every care is taken to exclude advertisements from doubtful sources, no responsibility can be accepted by the publishers for the bona fides of advertisers.

WORKSHOP EQUIPMENT

Buck & Ryan for Lathes and Workshop Accessories, drilling machines, grinders, electric tools, surface plates, etc.—310-312, Euston Road, London, N.W.1. Phone: Euston 4661.

Set "Matrix" Slip Gauges, 0.050" to 4.0", over 80 slips in fitted case including correction slips. Best offer. Also "Newall" dial guage, 25 thou range in 1/10,000", as new, £2 10s.—Box No. 8547, Model Engineer Offices.



OUTBOARD CLUTCH-BRAKE

This unit when fitted in place of normal solid pulley on The Electric Motor shaft saves the continual starting and stopping of the motor. When the clutch is operated a smooth powerful brake is simultaneously applied to the pulley which is integral with the unit. Fits on any motor shaft ½" or ⅝" dia. up to ¾ h.p.

Suitable for

★ MYFORD ★ BOXFORD
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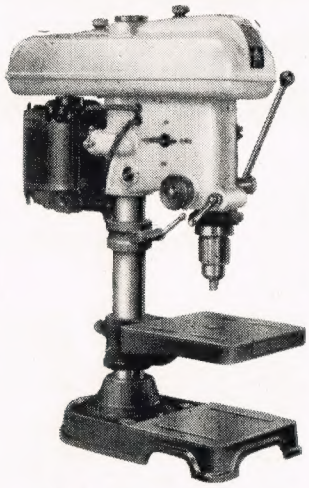

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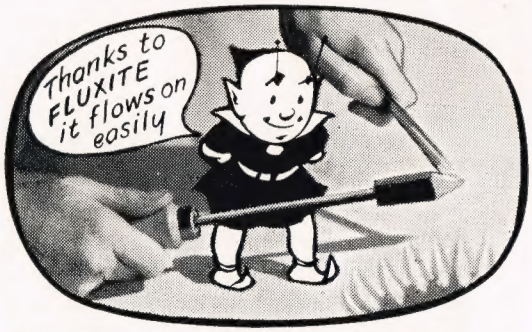

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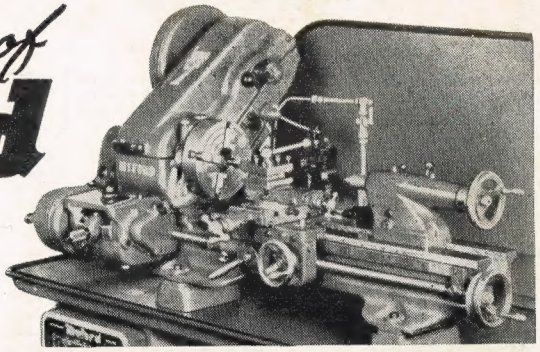

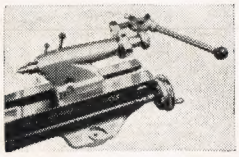

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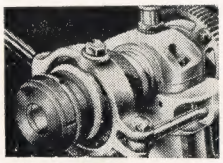

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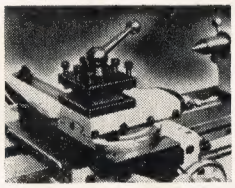

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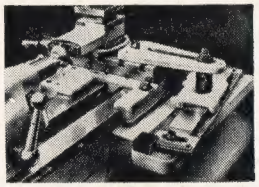

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